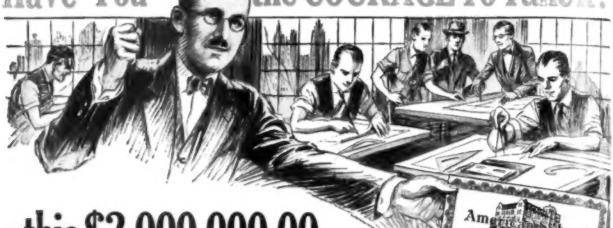
MODERN MECHANICS AND INVENTIONS

FEB
25¢

Freak Plane Crashes
See Page 44

What Will Happen to Flying? by
Capt. Eddie Rickenbacker

Have You the COURAGE To Take It?



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etc. That's a glimpse of how we help to make you a master electrician, and fit you to hold big jobs after graduation.

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Coyne is your one great chance to get into electricity. Every obstacle is removed. This school is 30 years old—Coyne training is tested—proven beyond all doubt—endorsed by many large electrical concerns. You can find out everything absolutely free. Simply mail the coupon and let me send you the big, free Coyne book of 150 photographs . . . facts . . . jobs . . . salaries . . . opportunities. Tells you how many earn expenses while training and how we assist our graduates in the field. This does not obligate you. So act at once. Just mail coupon.

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February, 1929
VOL. I NO. IX
Price - 25 Cents

MODERN MECHANICS AND INVENTIONS

A FAWCETT MAGAZINE
This magazine is not connected or associated with any other magazine of a scientific or mechanical nature.

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EDITED *by* EXPERTS

Listed below are the members of the Modern Mechanics board of editors, all qualified by national repute to serve as authorities. They will gladly answer questions from our readers concerning their departments. Address them in care of this magazine, Robbinsdale, Minn.

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Gain the magnetic popularity that makes you the center of any crowd. Business and social success is assured the man who can perform mystifying tricks. You can earn big money on the side or as a professional, as well as being the most popular person in your crowd. Why envy others' skill? You can learn Magic yourself, quickly and easily.

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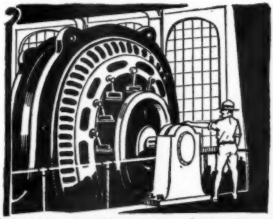
You Fellows Who Want BIG PAY Get into ELECTRICITY



$30 A DAY
Dear Mr. Cooke: I was making $25 a week when I enrolled. Now with my own Electrical Shop I make as high as $30 a day. A. J. Daigneault, 225 Worcester, Southbridge, Mass.

$1.50 AN HOUR
Dear Mr. Cooke: I had to work like a slave for 45c an hour before I enrolled. Now, thanks to you, Mr. Cooke, I make $1.50 an hour. G. W. Oprea, 4220 N. Meade Av. Chicago, Ill.

WHY earn $15 or $20 or $30 a week, when in the same six days as an Electrical Expert you can make $60 to $100—and do it easier—not work half so hard. Why, then, remain in a small-pay, no-future job that offers no chance for big promotion—no chance for big income? Fit yourself for a real job. **Get into Electricity.** That's where the big money is being made, and always will be made.

Electricity—The Big Pay Field

Today even the ordinary Electrician—the "screw driver" kind—is making money—big money. But it's the trained man—the Electrical Expert, who makes the really big money—$10 to $20 a day—$60 to $100 a week. Be a Big Pay man, yourself. Get in line, **now**, for one of these "Big-Pay" Jobs.

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I'll train you at home—in your spare time. You work just as you are working now—at your same job. My now famous "Work-Sheet and Job-Ticket" method, guarantees you simplified, practical training along work-shop lines. In a few short months you can step out of your old job into a new job—into electrical work where you can be a Big-Pay man in this Big-Pay field.

You Earn as You Learn

To learn Electricity my way you don't have to be a College man, or even a High School graduate. You can read. You can write. That's enough. With me, you get experience as you go along and make good money while learning. I'll show you how—and I'll give you, without extra cost tools and apparatus to work with—6 Big Outfits in all.

Sample Lessons FREE

So that you can see how easy it is to learn Electricity with my method, I will send you sample lessons and Job Tickets FREE. Just mail coupon.

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The "Cooke" Trained Man is the "Big Pay" Man

"They Snickered When I Got Up To Speak"

—But from the First Word, I Held Them Spellbound

THE banquet hall was crowded. Suddenly I heard the chairman's voice say—"We will now have a few words from Mr. Byron Munn." It came like a flash of lightning! He was unexpectedly calling on *me* for a speech!

As I started to get up, I heard a titter run around the table.

"Watch him make a fool of himself." I overheard someone whisper. "He's so bashful he's afraid of his own voice."

I knew they were expecting me to make myself ridiculous, but I only grinned inside.

I stood squarely on my two feet and started in!

"But When I Commenced to Speak"—

Almost from the first word, the smiles and derision faded from their faces. They were incredulous—amazed! Instantly the atmosphere became so tense that you could have heard a pin drop! No snickers nor sneers now! My voice, clear as a bell—strong, forceful, unfaltering—rang out through the banquet hall as I hammered home each point of my message with telling strokes! I let myself go—soaring to a smashing finale that almost brought them to their feet!

When I finished, there was an instant of dead silence! And then it came—a deafening wave of applause rolling up from one hundred pairs of hands—spontaneous, excited, thrilling!

Was Once a "Human Clam"

After it was all over, Jack Hartray fell into step beside me as I left the hall. "Gee, that was a great speech!" he said enthusiastically. "You certainly raised yourself about 100% in the eyes of every person in that place tonight. . . . And yet they used to call you 'a human clam'—and the quietest man in the office!"

It was true too. All my life I had been handicapped with a shy, timid and retiring nature. With only a limited education I never could express my ideas in a coherent forceful way. As a result I saw dozens of men with less ability pass me by simply because they were good talkers and knew how to create the right impression. It was maddening.

What 20 Minutes a Day Will Show You

How to talk before your club or lodge.
How to address board meetings.
How to propose and respond to toasts.
How to make a political speech.
How to tell entertaining stories.
How to make after-dinner speeches.
How to converse interestingly.
How to write letters.
How to sell more goods.
How to train your memory.
How to enlarge your vocabulary.
How to overcome stage fright.
How to develop self-confidence.
How to acquire a winning personality.
How to be the master of any situation.

A Lucky Accident

At last I accidentally ran across a little book entitled *How to Work Wonders With Words*. Between its covers I discovered certain facts and secrets I had never dreamed of. Difficulties were swept away as I found a simple way to overcome timidity, stage-fright and self-consciousness—and how to win advancement, popularity and success.

Today I hold the sort of position that I had always envied. My salary has been increased! I am not only in constant demand as a speaker in public but I am asked to more social affairs than I have time to attend. To sum it all up, I am meeting worth-while people, earning more than I ever dared expect and enjoying life to the fullest possible degree! And furthermore, the *sheer power of convincing speech* has been the big secret of my success!

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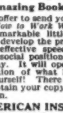

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Doubles Income in 6 Months

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A membership in the Association will give you the training you need to render these services,—that will enable you to earn $25 to $75 a week spare time—train you to install, repair, build all kinds of sets—start you in business without capital—prepare you for the $3,000 to $10,000 big-pay radio positions—help you secure a better position at bigger pay for you—give you the privilege of buying supplies at wholesale. **A membership need not cost you a cent.**

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This vital book, "Modern Salesmanship," contains hundreds of surprising and little-known facts about the highest paid profession in the world. It reveals the real *truth* about the art of selling. It blasts dozens of old theories, and tells exactly how the great sales records of nationally-known star salesmen are achieved. And not only that—it outlines a simple plan that will enable almost any man to master scientific salesmanship without spending years on the road—without losing a day or a dollar from his present position!

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The men who have increased their earning capacities as a direct result of reading "Modern Salesmanship" are numbered in the thousands. For example, there is E. E. Williams of Pomona, Cal., who was struggling along in a minor position at a small salary. "Modern Salesmanship" opened his eyes to opportunities he had never dreamed of—and he cast his lot with the National Salesman's Training Association. Within a few short months of simple preparation, he was earning $10,000 a year! Today he receives as much in 30 days as he formerly received in 365!

And then there is J. E. Muzzall, of Hopkinsville, Ky. He, too, read "Modern Salesmanship" and found the answer within its pages. A former freight clerk and department head at $200 a month, he recently reported yearly earnings running into five figures. B. F. Botton of Columbus, Ohio, wrote that his work as a salesman brought him annual earnings of $5,000—$7,000, an increase of 300% over his former income as a decorator. And F. L. Real of Wheeling, W. Va., a former cigar-maker, stepped into a position paying him $4,600 a year drawing account alone!

A Few Weeks—Then Bigger Pay

There was nothing "different" about these men when they started. Any man with average intelligence can duplicate the success they have achieved. For their experience proves that salesmen are *made*—not "born," as some people have foolishly believed.

Salesmanship is just like any other profession. It has certain fundamental rules and laws—laws that you can master as easily as you learned the alphabet. Hundreds of men who never had a day's selling experience before acquiring this remarkable training have been extraordinarily successful, often beating the records of men with years of experience from the very first day.

Free to Every Man

If we were asking several dollars a copy for "Modern Salesmanship" you might hesitate. But it is now FREE. So get your copy now. Learn the real truth about the selling profession, and about the tremendous demand for trained salesmen in every line, to fill city and traveling positions paying up to $5,000 and $10,000 a year. Last year this association received calls for 50,535 N. S. T. A. members from Wholesalers, Manufacturers and Jobbers. "Modern Salesmanship" tells the complete story in a vivid, inspiring way. A copy is yours for the asking, and your request entails no obligation. Simply fill out and mail the coupon. Do it now!

National Salesmen's Training Association

Dept. B-701, N. S. T. A. Bldg., CHICAGO, ILL.

National Salesmen's Training Assn.,
Dept. B-701, N. S. T. A. Bldg., Chicago, Ill.
Without obligating me in any way, send a copy of your Free Book, "Modern Salesmanship," and details of your System of Training and Free Employment Service.

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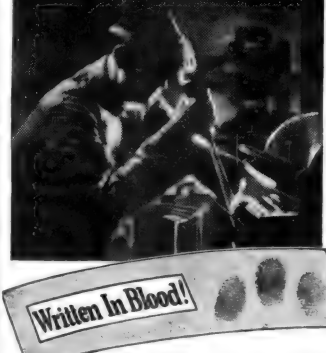
He Left His Calling Card

—Telltale Finger Prints!



THREE bloody finger prints on the cash register! He might as well have left his calling card — his doom was already written! These silent witnesses told the story—identified him —convicted him! Live through these thrilling adventures right with Detective McDonald as he gets Arizona's first finger print conviction. Mail the coupon below and get this gripping story FREE, with 12 others just as exciting!

13 True Detective Stories—*FREE!*

Gripping Mysteries! Gruesome Tragedies! Daring Deeds! Hair-Raising Climaxes! Every story will thrill you —grip you! You won't be able to lay it down until you have finished.

Think of it! Real Secret Service Operators give you "inside dope" on real crime cases. They reveal their secret workings — how they solved big crimes that baffled the police all over the country — how they won handsome rewards! These stories are YOURS FREE!— if you act quick! You would pay a good sum for them at a bookstore or news-stand. Here they are yours FREE—for the asking. Mail the Coupon NOW!

Big Demand for Trained Men

Make $2500 to $10,000 a Year

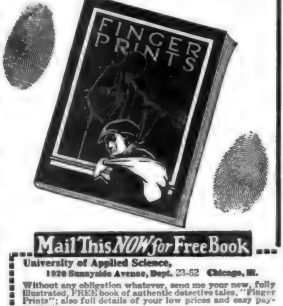
Finger Print Experts solved every one of these weird, blood-curdling crimes! Finger Print Experts gathered in the great big rewards—were appointed to high official positions for their work! Every day more and more trained men are needed. New Bureaus of Identification, new positions are opening up all the time. The field is uncrowded! Opportunities are unlimited!

YOU can learn Finger Print Identification easily, in a short time — in your spare time — at home! YOU can make $2500 to $10,000 a year as a Finger Print Expert. Find out how you can enter this most thrilling, adventuresome profession and make big money fast!

The Knock of Opportunity

Is the knock of the postman as he brings this book, "Finger Prints," to you. It brings you fascinating true detective stories. And more! It tells you how YOU can become a Finger Print Expert quickly and easily—at home, by mail—and at a very small cost—made still easier by our liberal Easy Terms. Mail that coupon NOW!

Send for this Free Book!



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University of Applied Science,
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Without any obligation whatever, send me your new, fully illustrated, FREE book of authentic detective tales, "Finger Prints"; also full details of your low prices and easy payment plans.

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1920 Sunnyside Ave., Dept. 23-52 Chicago, Ill.

Thank You for Mentioning Modern Mechanics When Writing to Advertisers

THE January number of MODERN MECHANICS carried a cargo greatly to the liking of every MODERN MECHANICS reader, if we are to judge by the letters written to the shop mail box. Among the features presented were several which were outstanding in popularity.

Of course Stewart Rouse's first installment on the building of the new Super-Parasol light plane was eagerly looked for and joyously received by all the light airplane "bugs." But the readers of MODERN MECHANICS are not exclusively airplane fans, as is attested by the popularity of W. H. Turner's splendid outline of Byrd's expedition, "Shackleton the Pioneer vs. Byrd the Scientist." The story of Shackleton's five months' imprisonment in the ice, of the dramatic destruction of his ship *Endurance*, and of the intrepid Briton's journey across 800 miles of open sea in the dead of a dark antarctic winter, affords vivid comparison of the relative hardships which Byrd plans to put on to the shoulders of Old Man Science.

G. H. Dacy's article on Model Power Boats vied in popularity with the spread showing the war fighting planes as used in the late world war. Many readers have expressed surprise at the picture of the De Havilland, which was really the plane used in the war instead of the later DH which fiction writers insist on dragging into their plots.

Concerning model power boats, Fritz Weber of Wayzata, Minn., writes:

More power to Modern Mechanics! I liked the story on Buddy Luke's little model power boats. How much does the Dart weigh and how long will it run at one winding? Please send me plans for a boat like it.

Wayzata, Minn. Fritz Weber.

To this letter of Mr. Weber's we answered:

Dear Mr. Weber:

We believe the Dart, when powered with spring motor, weighed about 5 pounds. Bear in mind that the speed with this propulsive machinery was but 3 miles an hour, and that Mr. Luke later installed steam which made a faster boat of the Dart. Three or four minutes would have been her radius with clockwork. Blueprints are always printed with our how-to-build articles. We have no large plans for the Dart, but will from time to time publish blueprints for boats like it.

We print this letter to again impress on our readers' minds that we do not have blueprints for the things we publish in MODERN MECHANICS. The entire article with full details is always published in the shortest, most terse way it can be presented. Readers are asked to bear this in mind. It saves us writing needless letters to inform readers of the fact.

A case in point is the popularity of the three-cylinder converted motorcycle airplane engine which appeared on page 42 of the December issue. A deluge of letters asking for complete details swamped the office for two weeks. This opportunity is taken to announce that full details for the building of a similar engine will appear in an early issue. This will include blueprints printed right in the book, like the plans of Gilbert Mickelson's aero ice sled printed on page 65 of this issue!

That's right in line with MODERN MECHANICS' policy of publishing the complete, the interesting, the unusual!

One other thought occurs to us at this writing and that is this: save your copies of MODERN MECHANICS.

A few months from now they'll be out of print and hard to get!

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IS YOUR JOB STEADY?

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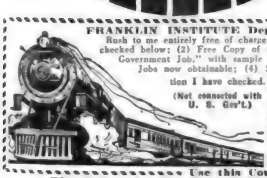

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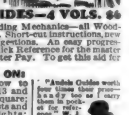

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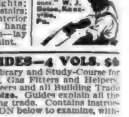

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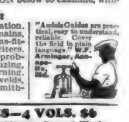

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No structure can be erected without plans drawn by a draftsman. No machinery can be built without plans drawn by a draftsman.

I train you at home, in Drafting. Keep the job you have now while learning drafting.

I will train you in drafting right where you are in your spare time. I have trained men who are making from $3,500.00 to $9,000.00 a year. There is a big future for draftsmen because you plan and supervise the work of others, or you go into business for yourself. Get started now toward a better position, paying a good, straight salary, the year around. Comfortable surroundings. Inside work.

Earn As You Learn

I tell you how to start earning extra money a few weeks after beginning my training.

Employment Service

After training you I help you to get a job without charging you a cent for this service. Employers of Draftsmen come to me for men because they know that Dobe Trained Men make good as they have learned drafting by actually doing the work themselves, in a practical way. Employers know they are not taking chances on men trained by me.

Money-Back Agreement

I train you at home under a positive Money-Back Agreement. If my training does not satisfy you after you have finished, you get every penny back.

Age or Lack of Education, No Drawback

Previous experience is not necessary. You do not need to be a college man or high school graduate.

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As my student you can write to me any time you want to and as often as you like and I will give you help on any subject pertaining to draftsmanship. I will advise you about jobs, extra work, fees and how to make extra money.

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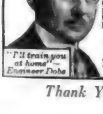

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More Letters From the Editor's Correspondence File

From far off Hawaii comes a letter which says in part:

About January 2nd I'm off to sea on a stretch of training duty with the Navy. I will leave here on the U. S. S. Burns (destroyer) to be transferred to battleship duty with the Pacific Battle Fleet for the cruise to South America and back. If you want a good Navy story shoot me your ideas and I'll dig it up for you.

Honolulu, T. H. John Edwin Hogg.

Mr. Hogg is an old hand at the reporting of mechanical developments and his sharp eyes will no doubt record many of the newer things which a good news hound would scent in naval developments.

OF COURSE, the rage for light airplanes and gliders burns undiminished. We are glad to be able to say to our readers who have been looking for material on the building of gliders that we have secured the services of one of the pioneer glider experimenters in the United States, Mr. Carl Duede. Mr. Duede recently built a simple glider which he has flown on a number of occasions, and full plans for the glider together with pictures of it in full flight over the rolling prairie lands of Iowa will be given in the March issue. Our light airplanes editor remarks that he thinks it feasible to mount the power head of an ordinary outboard motor on this glider, which would convert it to a powered sailplane!

Be that as it may, the March issue of MODERN MECHANICS will contain a variety of good things, not the least of which will be an article on the future of the airship, as told by the man who was second in command when the ill-fated Shenandoah broke apart in a storm over an Ohio cornfield some years ago.

Lieut. Commander Rosendahl, now commanding officer of the Los Angeles and a passenger on the Graf Zeppelin, tells us in this absorbing article what we may expect the lighter-than-air craft of the future to be like. Double hulls, triple keels—but wait until next month to read the remarkable predictions the Commander makes in his fascinating article!

From down in Louisville comes the following note from Thomas H. Atkinson, who says:

Please tell me where I can get more data on the sportplane as shown in the November number of Modern Mechanics.

The only thing I find wrong with Modern Mechanics is that it isn't a weekly. Give us more Aviation and how-to-build articles.

With kindest regards I am,
Yours truly,
Louisville, Ky. Thos. H. Atkinson.

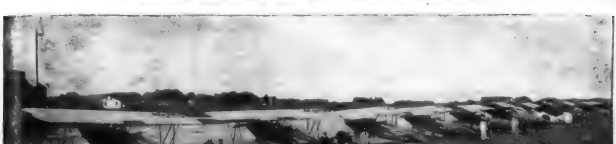
It takes a big staff of editors to get the magazine out once a month, to say nothing of all the artists and engravers who are kept busy! That suggestion of Mr. Atkinson's about making the magazine a weekly isn't such a bad one though, come to think of it. But it takes us all month to gather all the good things which go into one issue, and the artists are drawing and re-drawing until things are *right*, editors are planning and re-planning pages until they are *right*, and we're afraid the task would be too heavy. Then too, we wouldn't have time to sit down and tell you such things as this:

Charles Magee Adams

MARCH will carry a story showing how to build the little 1 h. p. aero engine, complete with timer, carburetor and 24-inch propeller which was shown on page 135 of the November issue. Readers asked us to secure such an article. We did!

Next issue will also carry complete details of the building of a marionette show. Hi Sibley wrote it, and anyone who is familiar with Hi Sibley's how-to-builds knows that there is a treat in store.

Nor is this all. Charles Magee Adams, MODERN MECHANICS' radio editor, whose likeness appears in this column, has built a simple one-tube radio set. This can be built for a trifling sum and will bring in stations nicely on a set of earphones. Watch for it in March!



YOUR Future in the Air!

THE future of aviation is tremendous—is assured. *But what about YOUR future in it?*

What do you see in the skies for yourself? A career of thrilling work with big pay and a glorious future can be yours in the *world's fastest growing industry!*

Aviation has passed the stage where ordinary training methods mean anything. *Where* you are trained, and *how* you are trained, will determine your place in Aviation a year—two years—five years from now.

It costs you *no more* to receive your training at the world's *largest and most elaborately equipped civilian air school!* Parks Air College, nationally recognized, is weekly sending out graduates to *good* jobs in the industry. Parks-trained pilots are making $700 per month and up!

One organization alone has agreed to take 200 of our graduate pilots by spring!

The photos on this page give you just a *few* glimpses of Parks Air College. Located in St. Louis, the recognized center of aviation in America, Parks Air College has facilities and opportunities undreamed of until you see them with your own eyes.

Twenty-six licensed training planes; fifteen transport pilots, over $150,000 worth of training equipment; hangars, classrooms, restaurant, recreation hall, etc.—Parks is like a great university!

You get flying instruction *every day* on brand new training planes equipped with OX5 and Whirlwind engines, fitted with stick and wheel control—*thorough flying instruction that turns you out a real pilot ready for success.*

Thorough Training

At Parks Air College you are taught straight flying, acrobatics, forced landings, vertical banks, cross wind landings, cross country flying, recovery from spins, and other flight details, by nationally known transport pilots.

And in addition to flying a pilot must know aerial navigation, meteorology, aero-dynamics; be familiar with such famous engines as Whirlwind, Caminez, OX5, Velie, Wasp and others. You must know how to *take care of your own ship! All this is included at Parks Air College!*

No wonder students have come to Parks from every state in the Union and from Canada, Panama and South America! No wonder they are now coming from Honolulu, Europe, even Africa!

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A well-known cartoonist's conception of my idea

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This gigantic model of Boulder Canyon was built by cutting pieces shaped to areas enlarged from a contour map

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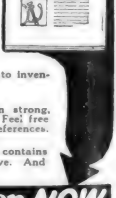

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1418 Pendleton Ave., St. Louis, Mo.
Without obligating me, please send me illustrated description of KRISS-KROSS Stropper and your offer of a 6-Way Razor FREE.
Name .....
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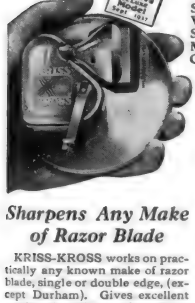
City ..... State .....
☐ Check here if interested in becoming representative.

—and it Brought Him 1129 Cool Shaves from One Single Blade!



Sharpens Any Make of Razor Blade

KRISS-KROSS works on practically any known make of razor blade, single or double edge, (except Durham). Gives excellent results with Gillette, Gem, Valet Auto-Strop, Keen-Kutter, Enders, Ever-Ready, Darwin, Schick, Christy and over 2 dozen others.

Another Triumph for KRISS-KROSS, The Most Amazing Shaving Invention Ever Patented! Mr. T. Liddle, of Illinois, Wrote Recently: "I Have Been Using One of Your Stroppers Since May, 1924. I Shave Every Morning and I Am STILL ON MY FIRST BLADE!" Read Astonishing Details. Then Act At Once For Real Shaving Joy.

NO wonder KRISS-KROSS marks such a radical advance in shaving comfort and economy! For now at last it has captured a secret that has baffled scientists for years! It actually reproduces mechanically the diagonal flip-flop master-barber's stroke that gives razor blades the keenest cutting edge that steel can take! Pressure decreases automatically. And in just 11 seconds you are ready for the coolest, slickest shave you ever had!

AN ECONOMY—AND A LUXURY, TOO

KRISS-KROSS not only introduces you to undreamed-of shaving luxury—but cuts shaving costs 83⅓. It makes your blades last almost indefinitely. Any number of cases are on record where a KRISS-KROSS user reports over 365 keen shaves a year from the same blade! For example, C. S. Stephenson, (Oklahoma) writes: "I have been using one blade continuously for 1 year and 9 months and have no idea how much longer it will last."—No wonder there are over a million satisfied users of KRISS-KROSS in America to-day!

GET FREE OFFER

And now—to introduce this sensational device that makes old blades keener than new—we are giving with it FREE an amazing new kind of razor. Instantly adjustable to any angle. Comes with 5 new-process blades. Find out all about this astonishing introductory offer. No obligation. Just fill out and mail the coupon *above* to-day!

RHODES MFG. CO., Dept. B-3543

1418 Pendleton Avenue, ST. LOUIS, MISSOURI
World's Largest Mfrs. of Mechanical Stroppers

AGENTS! $5 - $15 An Hour

Make big money with KRISS-KROSS! It is sold only through authorized agents who are making up to $200 a week and, in some cases, even more! All you do is demonstrate and take orders for this unique invention which is heavily advertised, but never sold in stores. Nine out of ten men want to own it as soon as they see how it works. R. S. Hopkins (Michigan) made $50 his first day. Spare time workers, factory men, mechanics, etc., often make $6—$12 extra a day just showing KRISS-KROSS to friends and fellow-employees. Generous commissions and bonus. No obligation. Get details and liberal proposition today. Check bottom line of coupon above and mail it now!

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An Air Wolf Snarled!

THE Renegade Flier had sharp teeth and he bared them in a defiant snarl of rage while his machine gun spat bullets and flame at pilots of the United States Border Patrol.

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Other Stories of Air, West, and War by

MURRAY LEINSTER, H. F. CRUICKSHANK, JAMES B. HENDRYX, H. BEDFORD-JONES, ROBERT CARTER, JAY LUCAS and others.

Just A Twist Of The Wrist

Banishes Old-Style Can Openers to the Scrap Heap and BRINGS AGENTS $6 to $8 IN AN HOUR

WOMEN universally detest the old-style can opener. Yet in every home in the land cans are being opened with it, often several times a day. Imagine how thankfully they welcome this new method—this automatic way of doing their most distasteful job. With the Speedo can opening machine you can just put the can in the machine, turn the handle, and almost instantly the job is done.

End This Waste and Danger

You undoubtedly know what a nasty, dangerous job it is to open cans with the old-fashioned can opener. You have to hack your way along slowly—ripping a jagged furrow around the edge. Next thing you know, the can opener slips. Good night! You've torn a hole in your finger. As liable as not it will get infected and stay sore a long time. Perhaps even your life will be endangered from blood poisoning!

You may be lucky enough to get the can open without cutting yourself. But there's still the fact to consider that the ragged edge of tin left around the top makes it almost impossible to pour out all of the food. Yet now, all this trouble, waste and danger is ended. No wonder salesmen everywhere are finding this invention a truly revolutionary money maker!

AGENTS!

$265. in a Week

"Here is my record for first 30 days with Speedo: June 15, 60 Speedos; June 20, 84 Speedos; June 30, 192 Speedos; July 5, 288 Speedos. Speedo sells to 9 out of 10 prospects."
M. Ornoff, Va.

PART TIME
14 Sales in 2 Hours
J. J. Corwin, Ariz., says: "Send more order books. I sold first 14 orders in 2 hours."

SPARE TIME
Big Money Spare Time
Bath, W. Va., says: "Was only out a few evenings and got 20 orders."

A "Million Dollar" Can Opening Machine

The Speedo holds the can—opens it—flips up the lid so you can grab it—and gives you back the can without a drop spilled, without any rough edges to snag your fingers all in a couple of seconds! It's so easy even a 10-year-old child can do it in perfect safety! No wonder women—and men, too—simply go wild over it! No wonder Speedo salesmen often sell to every house in the block and make up to $10.00 an hour.

Generous Free Test Offer

Frankly, men, I realize that the profit possibilities of this proposition as outlined briefly here may seem almost incredible to you. So I've worked out a plan by which you can examine the invention and test its profit without risking one penny.

Get my free test offer while the territory you want is still open—I'll hold it for you while you make the test. I'll send you all the facts about $75 to $150 a week. I'll also tell you about another fast selling item that brings you two profits on every call. All you risk is a 2c stamp so grab your pencil and shoot me the coupon right now.

CENTRAL STATES MFG. CO., Dept. B-2202
4500 Mary Ave. (Est. over 20 years) St. Louis, Mo.

SPEEDO

Central States Mfg. Co.,
4500 Mary Ave., Dept. B-2202,
St. Louis, Mo.

Yes, rush me the facts and details of your FREE OFFER.

Name .....

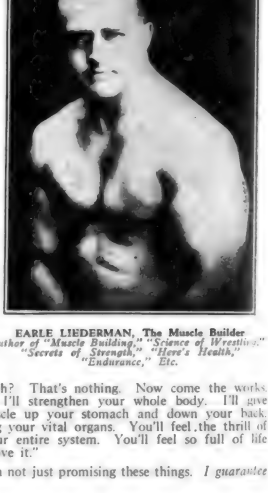
Address .....

City ..... State .....

( ) Check here if interested only in one for your own home.

Kill This Man!

THERE's a devil inside of you. He's trying to kill you. Look out for him! He tells you not to work so hard. What's the use? The boss only piles more work on you. He tells you not to bother with your body. If you're weak—you always will be weak. Exercise is just a lot of rot. Do you recognize him? Of course you do. He's in us all. He's a murderer of ambition. He's a liar and a fool. *Kill him!* If you don't he will kill you.



EARLE LIEDERMAN, The Muscle Builder
Author of "Muscle Building," "Science of Wrestling," "Secrets of Strength," "Here's Health," "Endurance," Etc.

Saved

Thank your lucky stars you have another man inside of you. He's the human dynamo. He fills you full of pep and ambition. He keeps you alive—on fire. He urges you on in your daily tasks. He makes you strive for bigger and better things to do. He makes you crave for life and strength. He teaches you that the weak fall by the wayside, but the strong succeed. He shows you that exercise builds live tissue—live tissue is muscle—muscle means strength—strength is power. Power brings success! That's what you want, and gosh darn your old hide! You're going to get it.

Which Man Will It Be!

It's up to you. Set your own future. You want to be the Human Dynamo? Fine! Well, let's get busy. That's where I come in. That's my job. Here's what I'll do for you:

In just 30 days I'll increase your arm one full inch with real live, animated muscle. Yes, and I'll add two inches to your chest in the same time. Pretty good, eh? That's nothing. Now come the works. I'll build up your shoulders. I'll deepen your chest. I'll strengthen your whole body. I'll give you arms and legs like pillars. I'll literally pack muscle up your stomach and down your back. Meanwhile I'll work on those inner muscles surrounding your vital organs. You'll feel the thrill of life shooting up your old backbone and throughout your entire system. You'll feel so full of life you will shout to the world, "I'm a man and I can prove it."

Sounds good, what? But listen! That isn't all. I'm not just promising these things. *I guarantee them!* It's a sure bet. Oh, boy! Let's ride.

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"Muscular Development"

IT IS FREE

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Dear Sir: Please send me, absolutely FREE and without any obligation on my part whatever a copy of your latest book, "Muscular Development."

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Street .....

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EARLE LIEDERMAN
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Let Me Start *you* in this ~ *Amazing new Business Of your Own ~ Now!*

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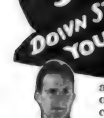
MAKE $5,000 TO $15,000 A YEAR in Your Own Home, Basement, or Garage Charging and Repairing Batteries

Here's your great opportunity to get into a Big Pay field that's growing by leaps and bounds—charging and repairing batteries. A $5 deposit brings all the tools and equipment to get started in a real business of your own that brings you $5,000 to $15,000 a year. Clip coupon below and get complete facts.



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Address me Personally. C. F. Holmes, Chief Engineer Independent Electric Works, Dept. 8, 5116 Ravenswood Ave., Chicago, Ill.

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I have invented a new Service Station Charger which saves 40% to 60% in electric current, yet handles 50% to 70% more batteries than similar outfits. Millions and millions of batteries in daily use by auto owners everywhere. Amazing new principle of my Service Station Charger simply scoops up all the business in town for you. My Free Book tells you how to get started.

$85 a Week for McDermott

No Experience or Education Required

Why go along at $25, or $30 a week when the battery fields holds out an opportunity for you to make upwards of $5,000 a year? Easy to get started with my charger. When the outfit arrives, you're all ready to begin business. Simply let the business roll in. Charger is automatic and requires no attention during operation. Profits go into your pocket without effort on your part. Free Book tells how.

$4250 in 18 Days for Whalen

$5.00 is All You Need to Start

Clip coupon and get your Free copy of my book "Big Profits." Read how hundreds of other fellows like yourself have established themselves in their own business. See the description of my amazing Service Station Charger. Find out about my plan for establishing you in this Big Pay field for only $5. Along with the charger goes my complete outfits of tools, supplies, testers, advertising—in fact everything that you need to do business—you can take in $20 a day or more right from the start. Get your copy of this book quick.

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If you are earning Less than $90.00 a week mail Coupon

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Our employment service starts working for you the moment you enroll for Film-Way Training. Employers want Film-Way trained men and we keep our students in touch with these opportunities, placing them in big pay jobs as rapidly as they are prepared. Opportunities are open in radio, aviation and automotive electricity, sub-station operation, wiring, contracting, etc.

This part of our service to every student costs you nothing extra. Remember, you must be satisfied with Film-Way Training and service or it costs you nothing.

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Actual motion picture films show you the inside of great power plants, broadcasting stations. They show you close-ups of men doing electrical work and of various types of electrical machinery in operation. Animated diagrams, too, make the facts about Electricity simple as A B C.

This DeVry $75 Projector GIVEN

To show these movies in your own home you are given a $75 DeVry standard model school projector. So simple to operate anyone can use it without previous experience. Operates from light socket or with farm lighting equipment, or automobile battery. Think of it, everything for these movies furnished to every student at *no extra cost.* It's all a part of our course and service and *you can get this nowhere else.* And you own a projector you can use in showing all kinds of movies at home!

What a Practicing Engineer Says of Film-Way Training

Charles E. Fitz, M.E., E.E., formerly associated with Steinmetz in the General Electric Laboratories, says: "I am amazed at how clearly and simply you explain the facts about electricity. The points are so much easier to grasp than by usual methods of instruction that the student must make quicker, surer progress."

THIS giant industry is constantly calling for more trained men to fill jobs that pay $70 to $200 and more weekly. You can fit yourself for a big pay job in Electricity in a new and amazingly easy way. At home, in your spare time, ***with real moving pictures to guide you,*** you learn how to do electrical work, and you are soon ready to enter big pay ranks.

This Entirely New Way is Easier, Quicker, Surer

Film-Way Training is endorsed by experts both in teaching and in practical electricity, as the ***easiest and quickest way to master this subject.*** Think of it, real moving pictures of all kinds of electrical machinery in operation, shown right in your own home! ***Moving diagrams explain how electricity acts and how to control it.***

You Need Not Pay a Cent

We pledge to give you the training and employment service necessary to get you a better job and more money, or you need not pay a cent. We make this pledge in writing to every student on enrollment. So you take no chance, you cannot lose!

Fascinating as Seeing a Show

No wading through a lot of dry text book matter. The facts about electricity and electrical work are here made as live and fascinating as any picture show you ever saw.

FREE SEND NOW for this Book *"The Film Way to Bigger Pay"*

Our big free book explains and pictures how we use movies to train you. Send for it today. Salesmen with school experience wanted.

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Send your book, "THE FILM WAY TO BIGGER PAY," with full facts about this new, easier way to master electricity.

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TAKE THE FILM WAY TO *Bigger Pay*

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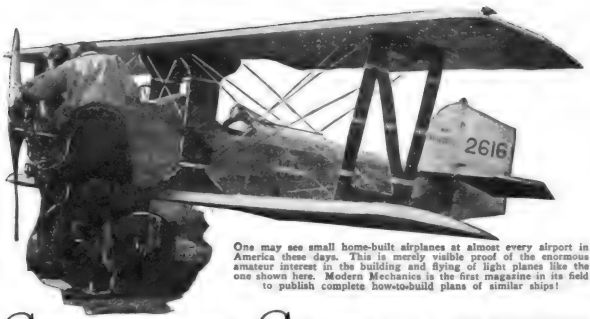


One may see small home-built airplanes at almost every airport in America these days. This is merely visible proof of the enormous amateur interest in the building and flying of light planes like the one shown here. Modern Mechanics is the first magazine in its field to publish complete how-to-build plans of similar ships!

AIR-MINDED AMERICA

AN AVIATION EDITORIAL

WHEN boys and girls delve into their history books in years to come, they will find a new year to remember along with such epochal dates as 1492, 1620, 1776, and 1918.

They'll jot down May 20-21, 1927, the date of Colonel Charles A. Lindbergh's flight to Paris, as marking the century's outstanding achievement in aviation. It was Lindbergh's "hop" that made America, as a nation, air-minded.

Now, in 1929, we look back upon accomplishments in flying that will mark the last two years as the beginning of a new era in aviation. Byrd's flight over the North Pole; the longest non-stop flight, New York to Germany, made by Chamberlin and Levine; the Southern Cross's sensational flight from the United States to Australia via Hawaii; the Graf Zeppelin's round trip voyage through the air from Germany to America—these are the highlights of the heyday of aviation.

Such great deeds have made America air-minded. It is a revelation to see the flood of letters that come to Modern Mechanics magazine bearing witness to the interest in aviation.

In recognition of America's great interest in flying, Modern Mechanics is the first magazine of its kind to attempt the publication of complete construction plans for light air craft.

True, this is a difficult and expensive undertaking—to supply our readers with working drawings and building instructions for a number of thoroughly tested, commercially produced light planes. But the Modern Mechanics expert staff of aviation editors, headed by Major H. H. Arnold, former assistant chief of the United States Air Service, have spared neither expense nor effort in securing these plans. As a result, each issue of this magazine carries not only construction details which would cost the reader from $15 to $25 for blueprints alone, but it also carries flying lessons by Pilot Gene Shank, photos and other articles dealing with all phases of airplane construction and progress.

What Will Happen to

by CAPT. EDDIE RICKENBACKER

Commander of the First A. E. F. Air Squadron in the World War.

GIANT dirigibles a mile in length, airplanes capable of flying at 500 miles an hour—these are only two amazing developments which Capt. Rickenbacker predicts are waiting just around the corner of the new air age in which we live. Being the greatest of America's war aces as well as a motor car engineer of national reputation, Capt. Rickenbacker's predictions are those of a recognized authority.

MEN wonder today whether they will live long enough to see the day of airplanes. As matter of cold fact, that day is here now and we hardly realize it. We travel more commercial miles by air in this country than in all the rest of the world combined, covering 32,000 miles every twenty-four hours—a figure that will be doubled within three years.

Development of air transport will help to open vast areas of territory now unsettled. Such development requires no right of way. Tracks and highways are not needed. Only terminal facilities are required and these necessitate only a modest investment.

Ten per cent of the annual maintenance cost of good roads in the United States would supply a fully equipped air port, one mile square, for every town of 500 population or more in the country.

Railroads will use the airplane. They lost short haul business by neglecting the bus in its early day, and they are not going to lose passenger travel, mail, express, parcel post, and light freight to the airplane. This sort of traffic will normally go through

Twenty hours by rail between New York and Chicago is considered fast time today. With airplanes traveling at 500 miles an hour—as Capt. Rickenbacker predicts they will within three years—the 1,500-mile journey will be merely a pleasure jaunt between breakfast and luncheon.

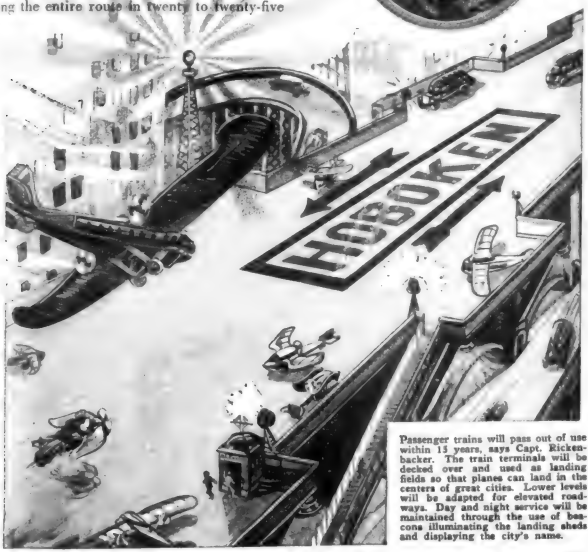
FLYING?

Read the Amazing Predictions of America's Wartime Ace

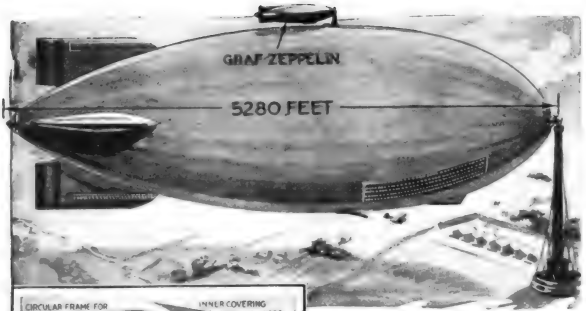
the air and would make up the biggest transportation industry in the world. The railroads see the possibility and are intent upon developing it.

One feature of their plans is the combination of Pullman and plane service for cross country travel. The New York Central will haul passengers from New York to Detroit over night. They will take a plane to Fargo, North Dakota, during the day and entrain for Spokane for a second night's ride. The following day they will fly on to the coast. The Pennsylvania is organizing a similar service with changes at Columbus, Wichita, and Tucson.

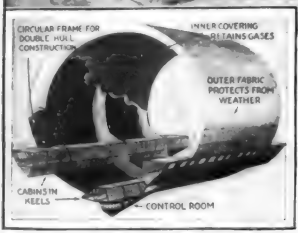
Within a few years this combined service will be superseded by airplanes covering the entire route in twenty to twenty-five



Passenger trains will pass out of use within 15 years, says Capt. Rickenbacker. The train terminals will be decked over and used as landing fields so that planes can land in the centers of great cities. Lower levels will be adapted for elevated roadways. Day and night service will be maintained through the use of beacons illuminating the landing sheds and displaying the city's name.



Immense as it is with its length of 750 feet, the Graf Zeppelin is a mere pygmy moored atop one of the mile-long dirigibles of the future. These huge ships will never land, but will take on supplies and passengers from smaller ships which rest on its back, and by planes carried inside the bag and shot out from launching platforms. A city full of people can live inside the cabins in the fins.



Sectional view of one of the new dirigibles ordered by the U. S. Government, to be the largest yet constructed. It will have a double covering of fabric, the outer for weather protection and the inner for retaining the gas cells.

hours. These planes will have sleeping quarters, dining salons and all requisite travel comforts.

All rail lines will be paralleled by air lines under the same management. Traffic is the railroad companies' business. They are awake to the possibilities of air transport and are not going to let new men take the business away from them. They will build their own systems and compete with newcomers or will buy them out.

It may safely be predicted that passenger trains will pass out of use within fifteen years. Long hauls will be covered by air, short hauls by private cars and by public buses.

Railroad yards will decked over and utilized as landing fields so that planes can alight in the hearts of the cities. Railroad traffic, in the meanwhile, will be handled by electric locomotives on the lower levels.

These changes will come about because time demands them. Time cannot be saved up and used as needed in the future. It must be used now if at all, and the man who uses it most effectively has all the advantage in the commercial competition of today. That competition is pitiless—far more so than in military combat where all the resources of science are marshalled to the help of the injured. In commercial warfare, the man is soon eliminated who does not make the most effective possible use of his time.

Bigger Planes to Come

The present transport plane is as obsolete as a five-year-old car. Cruising speeds of 100 to 150 miles an hour for transport planes are perfectly feasible. With such planes the Pacific Ocean, in hours of travel, would be brought as close to New York as Detroit is now, and Detroit would be four hours from New York instead of the fourteen hours required by the fastest trains.

Air transport would thus, in effect, re-

Dirigibles of the Future Will Take on Supplies and Cargo in the Air

duce the size of the United States to the size of the state of Texas. The fastest train across Texas requires twenty-four hours. At an average speed of 150 miles a plane crosses the continent in less time than that.

It is very difficult to conceive of speed in terms of the future. The Spad plane as used by me during the World War travelled 125 miles an hour and was the fastest thing in the world. Single seater planes have been built capable of 350 miles an hour. It is only a matter of engineering to build a plane to go 500 miles an hour and someone will do it somewhere on earth within three years.

Big as present planes are, they are mere kites in comparison to the ones to be used in the future. The biggest thing we know of on earth is the ocean of air in which our earth floats. No one has ever conceived how vast this ocean is, and upon it every city and town is a port. The possible size for a plane or dirigible is therefore limitless, and we must expect them to increase largely in size because the ratio of pay load increases with the size of the unit. Size is now merely an engineering problem of control.

A plane is now being built in Germany that will carry 100 passengers. It is powered with 12 engines of 500 horsepower each, giving a total of 6,000 horsepower, and will fly at full load with any seven of these engines. It will have a cruising radius of 5,000 miles.

Cruising radius is merely a matter of supplies. When planes and dirigibles can carry reserve supplies of oil and fuel, they can go anywhere. Under present conditions, they must go straight ahead on their course. If ocean vessels had to operate the same way, they would lose 15% to 20% of their shipping every year through storms. But ships go around storms or lay by until the weather ahead has cleared. Very soon aircraft will do the same.

In fact, the *Graf Zeppelin* abundantly proved the value of cruising radius in crossing to Lakehurst. It travelled far south to avoid a storm, was delayed a full day, yet arrived after 6,000 miles with sixty-five hours of fuel still in the tanks.

The *Graf Zeppelin* with its 3,600,000 cubic feet capacity is now the biggest dirigible in the world. But the United States Government has signed a contract with the Goodyear Tire and Rubber Company for two dirigibles of 6,500,000 cubic feet capacity—a 100% increase in size between models.

England is building two dirigibles of 5,000,000 cubic feet which are equipped with dining rooms for fifty people, dance floors, promenade decks, showers in passengers' cabins. One of these will go into passenger, mail, and express service between London and Sydney, Australia, going always from west to east with the prevailing winds and thus circling the globe on each round trip. The other is expected to go into service between London and Buenos Aires. This trip, which now requires thirty days by the fastest boat connections, will then be made in three and one-half days.

Dirigibles can be built to any size and may eventually be a mile in length and of 25,000,000 to 30,000,000 cubic feet capacity. Such ships would be capable of staying in the air five or even ten years, making repairs en route and taking on new supplies without stopping.

The dirigible would therefore go continually on its way around the world. As it approached a city another ship would go out to meet it and dock on its decks. It would unload supplies, exchange cargoes

GLIMPSES INTO THE WAR RECORD OF RICKENBACKER

Commander of the famous 94th (Hat-in-the-Ring) Squadron, Captain Rickenbacker is officially credited with having shot down 26 enemy aircraft—more than any other A. E. F. flier. He was awarded the Distinguished Service Cross for extraordinary heroism in action.

This was only the beginning, however. Before the war was over he had won seven more citations for conspicuous bravery. He specialized in attacking groups of planes; his citations tell of fights with three, four, five and six enemy planes at one time.

Captain Rickenbacker Summarizes His Ideas on the Future of Flying

and passengers, and possibly relieve the crew, then take off again and return to its home city.

It is worthy of note that the airplane would be largely useless without the automobile. No one would use aircraft if he had to travel by horse and buggy from the airport to the heart of the city. There must be cars at both ends of the airline, which increases the use of cars and means increased business for automobile makers.

Private ownership of planes is coming through the keen interest of the younger generation. The motor car was developed in precisely the same way. It was commercialized by the generation succeeding the one which created it. Older men have responsibilities which restrain them from developing the new to its utmost extent. The youngsters, who grow up with it, make full use of it.

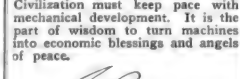
Private ownership of airplanes will be common with the younger generation now growing up.

Railway passenger trains will be obsolete within 15 years, giving way before faster airplanes with which they cannot compete.

Within three years someone will build a plane that will travel at 500 miles an hour.

Huge dirigibles will stay in the air ten years at a time, making continuous journeys around the earth.

Airplanes carrying giant burning lenses could focus the sun's rays on entire cities, melting them. Civilization must keep pace with mechanical development. It is the part of wisdom to turn machines into economic blessings and angels of peace.



Buying Hats by Radio

Twenty-five years ago the social radius was five miles and the commercial radius not to exceed ten miles. The automobile extended the social radius to twenty-five miles and the truck increased the commercial radius at a very conservative estimate, to fifty miles. Now aircraft extends these limits to 75, 100, 150 miles and puts cars to work at both ends of the line.

These amazing developments in transportation are equalled, if not even surpassed, by improvements in communicating ideas. Here radio and television are supreme. And so rapidly is it being developed, that very soon important advertisements will be dispatched by television to the newspapers of the country the night before insertion. Last winter an advertisement of a bond issue was televisioned across the ocean to Paris and was on the streets there within three hours of its release in New York.

Three days before last Easter, a milliner in New York received from Paris a television showing in colors a new hat, copied it in his designing department, and had it on sale within three hours of its showing in Paris.

It is the clear obligation of the present generation to develop these possibilities nationally and internationally and devote them to world understanding and world peace. We have already proved what a wealth of good will can be gained from transportation and communication by our glorious apostle of youth—Lindbergh. We should send a thousand Lindberghs every day with messages of good will and with merchandise. A better world wide understanding will result, and will eliminate the jealousies, intrigue and envy that have caused wars.

We must do it before the next generation comes to manhood and womanhood. We must turn all these mighty forces to the service of mankind.

If we fail to do it, civilization is in jeopardy. When wars are fought in the air, there will be no "No Man's Land" but every man's house top will be the front.

Aircraft of today will carry bombs of 5,000 pounds. They can be built to carry them of 10,000 pounds, 20,000 pounds—large enough to lay waste whole city areas, wrecking the buildings and destroying the people. It is possible for planes to use giant burning lenses weighing tons with which they could focus the rays of the sun upon a city and melt it.

These deadly weapons could thus be used for the destruction of mankind. But they need not be so used. It is the part of wisdom to turn them into economic blessings and angels of peace.

New Auto Lock Shuts Off Gasoline and Ignition

AUTOMOBILE thieves are thwarted by a new steering wheel lock which has been invented in England. This lock fits the steering column in the conventional manner, as shown in the photo. When locked it not only makes steering impossible, but also cuts off the ignition and stops the gasoline flow.

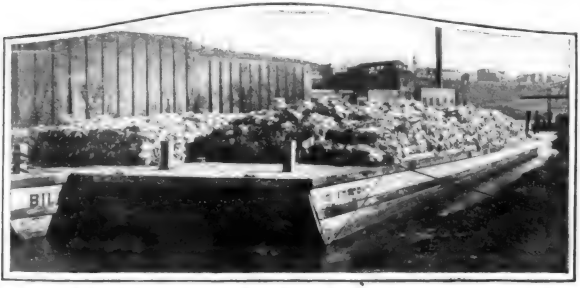
Most automobile thieves depend upon speed to accomplish their getaway. With three essential running features of a car shut off it would almost be impossible to drive it away. The time that it would take to pick all three of these safety devices would be more than most car lifters would dare risk.

METAL-LIKE GLASS

ANTI-AIRCRAFT gunners will have to be extremely accurate when they train their pieces upon the new "phantom" air plane that has been built by the British Air Service. The ship is made of "plass," a material that is like glass in appearance, but is unbreakable and can be handled almost like metal.

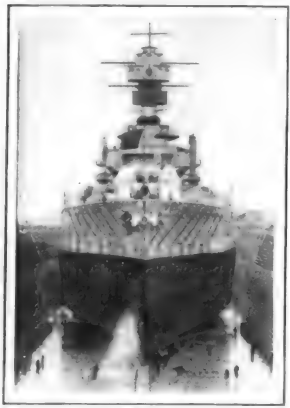
CANAL SERVICE IMPROVED BY NEW TYPE BARGE

USING the inverted v-bottom as developed by the world famous Sea Sled Corporation, these new type canal boats are being employed by operators of barge lines on the New York State system of barge canals. Every year the need for rapidity in transportation has urged towboat captains to allow their speeds to creep up. The resulting maintenance costs in keeping the banks from caving due to the wash of the tow became serious. Finally the problem was put up to the Sea Sled Corporation, who have made use of the inverted v-bottom principle in fast boats. The new type barges gather the bow wave and leave no wake to wash down the canal banks.



Shown above is one of the newest type canal barges which is being put into service by operators and shippers using the New York State Barge Canals. This type of barge makes use of of the inverted v-bottom.

Huge Underwater Bulk Indicates Weight of Ship



IT IS a well known fact that icebergs have nine-tenths of their bulk under water. It is also popularly supposed that ships have a great deal more bulk above water than below, and in some cases this is true. This, however, is not the case with Uncle Sam's gigantic armored battleships, as is attested by the photo shown herewith. The great belts of armor which are fastened to the side of these ships can be plainly seen in the photo. These armor belts, coupled with the great weight of the guns and the massive machinery which a battleship must carry, account for the tremendous displacement. The ship in the photo is undergoing a bottom cleaning before beginning her recent trip to South America with President-elect Hoover.

VACUUM CHIMNEY SWEEP

ANOTHER romantic figure of other days has passed out of the picture. The chimney sweep has been sacrificed on the altar of modern machinery. The modern chimney sweep has a truck with a vacuum bag which sucks the soot out of the chimney.

GIANT AMPHIBIAN JOINS PACIFIC COAST AIR SERVICE

THIS giant Sikorsky amphibian, recently purchased by the Western Air Service, Inc., is adapted for service on land or water. The large cabin of the plane is in reality a boat, which floats the plane when a water landing is made. The retractable wheels which can be seen protruding below the hull are used when a landing field is at hand. These wheels are drawn up above the water line of the hull and do not hinder a sea landing, nor can they be torn off by the force of waves.

Commuters between Catalina Island and the mainland need not fear a forced landing while at sea in amphibian planes, for they are equally safe on land or water. Another safety factor provided by the Sikorsky firm is the use of two motors.

Commuters between Catalina Islands and Los Angeles were recently introduced to a new passenger plane, in the form of a Sikorsky Amphibian. The plane is shown in the view above.

New Self-Lifting Auto Jack is Invented in England

FLAT tires need not worry the English motorist if he has his car equipped with the new type self-lifting auto jack that is shown in the adjoining picture. This jack, which is attached to each of the four wheels, slides from its place so that the driver need only back up the car and when the wheel has been lifted from the ground by the eccentric steel drums, he simply locks his brakes and changes the tire. Having made the change, he loosens the brakes and allows the car to move forward until the tire is again on the ground. After the jack has been returned to its place at the center of the wheel the car is again ready for the road.

This new type jack, shown below, is attached to the brake drum of each wheel.

PERMANENT LETTER FILE

ANYONE possessing a phonograph can read the "photovox letter" shown above, by merely placing the plate on a machine and playing it like any other record. The chemical process that was devised to manufacture the photovox disc and retain a permanent record of the spoken word was the work of two Vienna inventors, Prof. Eugen Fischer and Chemist Otto Zecha.

The difficulty with the ordinary reproducing record that can be made at home or in the office is that the air will make the record deteriorate so that it is unintelligible. The "photovox" plate has been made impervious to the air by the new chemical process.

DOG SHOWS MUSICAL TALENT

EVERY now and then a dog is seen on the stage that seems to almost have human intelligence. This dog shows exceptional musical ability when he sits on the bench of an automatic piano and pats the keys, as the piano plays. That he has a musical sense of rhythm is shown by the fact that he pats the keys in time with the piece that is being played. He is owned by a Berlin vaudeville performer.

"Sitting up" is not the only trick this dog can do. He can sit up and play a piano at the same time.

Freak Plane Crashes

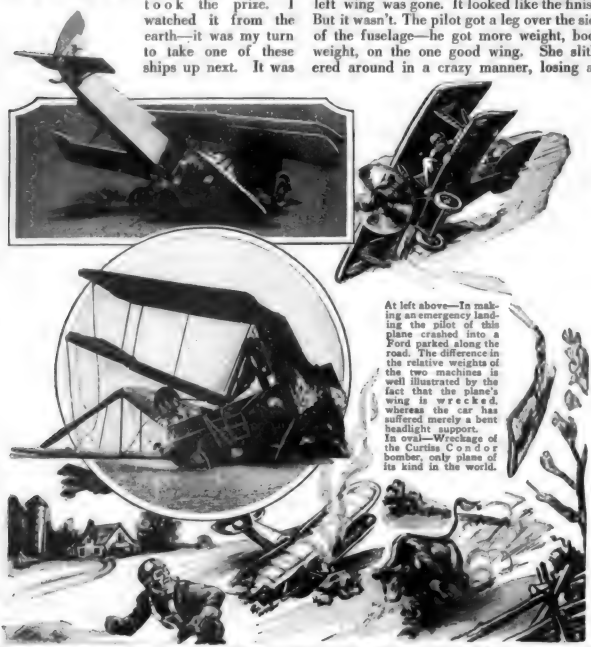
By RAOUL WHITFIELD

Wartime Aviator and Famous Author of Air Fiction

ISSOUDUN, FRANCE. August, 1918. Grey sky, spit of rain. Two fifteen-meter Nieuports doing combat work at eight thousand, just under the clouds. And then, wings too close, the crash!

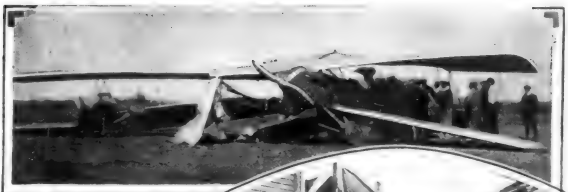
I've seen a lot of sky bangs. This one took the prize. I watched it from the earth—it was my turn to take one of these ships up next. It was my *turn*, but I didn't take one. They tangled wings, and one ship spun free like a top. A wing dropped loose as she spun, But not *her* wing—the other plane's.

I watched the other. She was sliding toward the field in a sort of half spin. Her left wing was gone. It looked like the finish. But it wasn't. The pilot got a leg over the side of the fuselage—he got more weight, body weight, on the one good wing. She slithered around in a crazy manner, losing al-

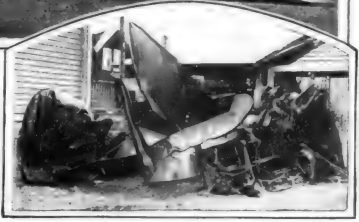


At left above—In making an emergency landing the pilot of this plane crashed into a Ford parked along the road. The difference in the relative weights of the two machines is well illustrated by the fact that the plane's wing is wrecked, whereas the car has suffered merely a bent headlight support. In oval—Wreckage of the Curtiss Condor bomber, only plane of its kind in the world.

You aren't always safe even after you've landed a damaged plane. Ask the pilot chased by a Texas steer!



Not all plane wrecks occur in the air. The one above was caused by a taxiing plane striking a parked ship.



Parachutes saved the lives of the two pilots of the above plane, who jumped when the ship got out of control. A larger percentage of airplane crashes than the public thinks cause no injuries to the passengers.

titude in a series of queer dives and level-offs. The pilot was out of the cockpit—then in it again. He worked hard. I looked for the other Nieuport. She was nosing straight for the earth—and pretty close. Suddenly she came out of the dive. She half zoomed, went off on a wing. She got level—lost altitude very slowly. She stalled, struck almost gently. My eyes went to the plane with only one wing. She was down to three thousand—and actually g l i d i n g! The pilot got down in a fast landing—got off with a broken leg and arm, and some cuts. The other pilot had a scratch on his chin. And they'd sky-banged at eight thousand!

St. Jean de Monts, France. September, 1918. Flying at three thousand. Along edge of Bay of Biscay. Sergeant in rear cockpit, ready to throw out folded target, to be towed. I zoom her, so that the folded silk pack will have room in the toss. I *start* to zoom her. We hit a down current—the nose drops. Sergeant, off balance, throws back the silk. She jams between the rudder and elevator fins. I cut the

Mr. Whitfield tells in his article of the prominent role he played in the unusual airplane crash pictured above.

A sky full of parachutes! This picture demonstrates how a damaged plane can be vacated within a few seconds.

power and try to move the elevator fin. No go. We glide for the beach—a mild glide. But we're going to crash unless I can get the nose up. The stick is frozen—the silk target pack is jammed tight. All the way down I work. But that silk won't free. We hit sand—the under-gear buckles. Wheels in one direction, struts in the other.

Ten days later, at the same field, a ground officer neglected to have petrol placed where petrol *should* be placed in a flying ship. DeHaviland Nine, she was. I took off, got about eight hundred feet over the beach, when the engine died abruptly. Couldn't make the field—dove for the sand. I could use the controls, this time—but no power. Dropped straight for a half dozen of those bathing houses the French wheel down near the water. The bathers heard the D. H.'s wires shrill. They sped forth in various stages of dress and undress. But it wasn't funny. Stretched the glide and cleared the last bath house by inches. Blew the left rudder in the set-down—nosed over. No personal damages.

Kelly Field, Texas. March, 1918. This

A thousand-foot drop into Boston Harbor gave the pilots of the above plane a ducking, but no serious injuries. The plane floated for several hours.

particular cadet let a Curtiss "Jenny" skid on the ground, while taking off. He got her off, minus the landing gear. Just a few shreds left. They rolled out the ambulance, waved pieces of the under-gear up at him—and waited to see what he'd do. I'd *like* to write that he did the best thing—and stalled her down. But he didn't. He stayed up until she was almost out of gas—and gave every one on the field a terrible hour. Then he made a fast forced landing. His plane pin-wheeled all over the place. The cadet had a broken nose and a lot of bruises.

Mines Field, Calif.—at the National Air Meet, last year. Lieutenant Hasselman, Navy pilot, was banking vertically around the home pylon, located some two hundred yards from the packed stands. He was doing about a hundred and fifty miles an hour, in a V. B. 2B Squadron, Boeing Pursuit ship. His plane's nose got down when he had a wing to the sky, and a wing to the earth, about a hundred feet below. She slipped off, but he got her fairly righted before she struck dirt. It was a nasty crash. She pin-wheeled several times. The friend with me was very certain, with his view from the dead-line, that the pilot was finished. But I remembered past air crashes and ground crack-ups. I wasn't so sure. Five days after the crash the pilot was transferred to a big Fokker hospital plane and winged back to his base at San Francisco.

Fatal air accidents, however, are becoming rarer all the time. The parachute

In the circle is shown the tail assembly of a naval plane which crashed into the heart of a crowded street in Copenhagen, killing the three occupants. Below is the wreckage of a plane which collapsed while looping the loop, killing the pilot and a six-year-old deaf mute who was taking the trip to cure his malady. In neither case were the fliers equipped with parachutes, which would easily have lowered them in safety.

saves hundreds of lives every year. They have even perfected parachutes which can lower a disabled airplane safely to the ground. Huge chutes they are, and mighty effective. Passengers aboard tomorrow's transport planes need have no worry in the very unlikely event that their machines crash in the air, as depicted on the cover of Modern Mechanics this month. All they'll have to do will be to pull a lever and, zip! The chutes grab hold and the planes drift easily to earth.

Talking Devices are

by GEORGE C. HENDERSON

MILLIONS of dollars are being spent by movie magnates in equipping studios for the production of talking pictures. Mr. Henderson visited a "talkie" in the making and in this article gives a fascinating glimpse of what goes on behind the scenes.

THEY'VE got to wear sneakers on their cowboy boots in moviedom now. The yelling director has been stricken dumb. His megaphone has gone back to the prop room. The big fellow with the blasting voice is outside the gates looking in, on the "extra list." They say he "bloops." The little lady who speaks with a hissing sibilance is out there with the blooper. She is called a "sizzler." The hollow-voiced tragedian is told that his tones are "tubby" (as if he were speaking into a tub) and if he cannot correct the defect, he goes out too. Weak voiced persons "get the gate" with those above mentioned. They are called "juice suckers."

They've invented a new lingo in Hollywood since the talking motion picture became the vogue. The human side of the big change has attracted first attention and this lingo has singled out defects that become magnified on the microphone and make the actor or actress ineligible in the talkies.

But changes in personnel have been few and inexpensive compared with the vast outlay in the mechanical and technical end. The fact is most stars, through voice culture and otherwise, can make good in the sound drama. A few who are "mike dumb" have had to be relegated to the silent screen. This is not so bad as it sounds. All pictures are taken first on the lot in the regular way, where voices do not count. The film is then run off and the executives decide where talking sequences will be inserted. Only important portions of the picture are re-shot in the sound-proof stages.

After the executives have selected the portions to be re-shot, one of the editorial staff is called in to write the "talking sequences." This is the conversation. He must give the matter great care. Sometimes he takes weeks for it. The dialogue must not only be snappy, interesting, dramatic and to the point; it must be entirely free of certain words. The letter S should occur rarely at the beginning or the end of a word. If a "sizzler" were to try to say, "Sister Susie's sewing shirts for soldiers" it would reproduce as one long continuous hiss after the voice-recording apparatus had got through with it.

Next come the rehearsals. Everything is rehearsed to perfection. There can be no prompting once the two ton doors are closed and the director becomes a silent spectator. Slurred speech, excess movement which means excess noise, the rustle of paper which makes a noise like thunder in the microphone, the pouring of a glass of water which becomes a loud "blop—blop—blop," the scraping of a chair leg over the floor, thus drowning out every other sound—all these little things must be prevented or arranged.

I watched them rehearse and film a scene at one of the big Hollywood studios (Metro-Goldwyn-Mayer). The set, which was like any other movie set in outward appearance except for the microphones hanging overhead and standing about, was located in a great concrete, sound-proof building. The construction of the building itself had been supervised by scientists. The walls were 8 inch thick concrete. Over that was a three inch layer of balsam wool, a half inch layer of acoustic plaster and a hanging of cheese cloth fastened on with chicken wire. The first sound stages were made by hanging felt against wooden walls. This would cut out the high notes but would not damp the low ones. The balsam wool in the new structure shuts out the high notes, the rigid concrete the low and the acoustic plaster the medium notes. The floor was made of layers of concrete, sand, cork and two thick-

Revolutionizing Movies!

Raquel Torres and Nils Asther enact a love scene for the "talkies." Director Van Dyke sits out of the camera's range, hoping they won't stutter. Note the camerman isolated behind a glass sound-proof cage where the clicking of his machine will not register on the microphone.

Al Jolson, shown above in a scene from "The Jazz Singer," scored a hit in his first talking picture. The combination of voice and acting as demonstrated in the "talkies" is especially effective in the case of a noted singer such as Jolson.

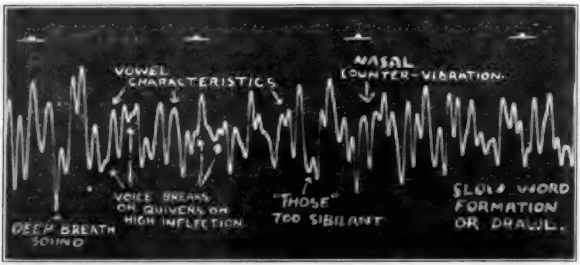
nesses of wooden floor. The cork absorbs mechanical vibrations from the ground.

It is very difficult to gain entrance. Even after everything had been arranged a policeman stopped us. It had been found expensive to admit visitors. They talked or scraped their feet and hundreds of dollars worth of work had to be done over again. Getting past the policeman, we came upon a scene of great animation. Here was a great vaulted room, cluttered up with big, powerful lights, the floor covered with wires, boxes and instruments and apparatus scattered everywhere, electricians, technicians, carpenters and roustabouts hurrying back and forth, men on girders overhead manning the overhead cranes that shifted heavy objects from one place to another. And right in the midst of it all an orderly little room f u r n i s h e d with fine carpets and drapes, chairs and divans—the set. Here the actors and actresses moved in range of the camera.

But where was the camera? We found it in a refrigerator-like vault, looking out on the set through double plate glass of the finest German make. Johnny Arnold, the camera man, explained that he had to enter this sound-proof vault and close the big heavy door to keep the clicking of his camera from registering in the microphone. It was hot in there, Johnny was perspiring. He said it made a camera man's job harder because he couldn't take any orders from the director.

Electrical engineers and acoustic experts were getting their apparatus set. A baritone walked around the set singing selections from an Italian opera to test the stage at every point. Another went around clapping his hands. The technicians were listening in, watching their recording de-

Voice Analyzer Tells What is Wrong With Actor's Enunciation



Here is the voice physician's diagnosis of the peculiarities of the voice of Anita Page, the movie actress. Many actors have been forced to make a study of proper enunciation in order that their tones may register pleasantly on the movie voice recorder.

vices as these tests were made. Rehearsals were completed.

"Ready for interlock," said Director Van Dyke to the switch board operator. The operator flashed signal lights. The camera motor, the recorder motor and the test record motor all were synchronized on a master distributor when an expert at the recording building threw a switch. The operator on the stage received the report, "interlock O. K." Arnold, the camera man, reported, "camera O. K."

The stage switchboard man pressed a switch which threw on a green light, the signal that camera was ready. In the room where the recording apparatus set, the expert switched on a white light. That meant the recording machine was set, that he had a wax record on the test machine and that the film making machine was all right.

Arnold entered his booth and closed the door. It was so hot and stuffy in there that he did not enter it until the last moment. The actor and actress, Nils Asther and Raquel Torres, took their seats at the table where they were to speak the love scene. The director took up a position off the set, out of range of the camera, but so that he could signal to Arnold. He watched Arnold throw on the motor and caught his signal. He snapped his fingers.

Suddenly the actor and actress began to talk. A snap of the finger set things to moving. There were no shouts of "Ready," "Action," "Camera," no waving of megaphones, no lurid denunciations. The director dare not move. He was afraid to unwrinkle the scowl on his face for fear it would crackle in the megaphone.

At the "mixer panel" overhead, two operators sat with earphones over their ears. They were reminders that this was an engineer's job. The director, who had been all powerful, had to give way to scientists. These operators listened intently to the voices. When they began to get faint, they turned knobs to raise the volume. As the actress turned toward the microphone they decreased the volume; when she turned away they increased it. They had to watch every movement. In his sound-proof room Johnny Arnold was turning his camera, unheard, as if he were in another world. The actor and actress went through the scene without interruption, as if they were alone in a garden really making love.

They stopped talking, Director Van Dyke motioned to Arnold. Signal lights flashed. The synchronized motors operating the camera, the recording device and the test record all were halted instantly. Johnny Arnold flung open the door of his refrigerator and stepped out, wiping his brow. The

Electrician is the Guiding Genius in Getting Voices on the Screen

man in the recording room had thrown off the interlock, placed the test record on the reproducer and taken the film from the recording machine and placed it in a box to go to the laboratory.

"Give me a playback," said Director Van Dyke. That meant he wanted to hear how the voices recorded. "Give me a playback," repeated the switchboard operator.

There was a general exodus into a room arranged like a theater, the monitor room. It was built like a theater so that the director could hear the voices as an audience would hear them. Everyone took seats. Up in the recording room, the man there put on the soft test record which he had made and which can be played but once. Voices began to speak again. Through the horns we heard what had been said on the stage.

At one point in pronouncing a word, one of the speakers had slurred it.

"Take it over again," ordered the director. Just for one word mispronounced the whole scene had to be re-taken.

It is impossible to estimate the thousands upon thousands of dollars that have been spent by the motion picture people for equipment, buildings, machinery and for experiment in this business of adapting the industry to the talkies. At this one studio two stages, each measuring 98 by 70 feet and constructed of the expensive, soundproof material have already been built. The recording building has 12,000 feet of floor space, the monitor room, 3,500 square feet. In the recording room were four separate recording machines, the battery rooms, cutting rooms, projection rooms equipped with the latest simplex projectors arranged for both record and light ray sound projection, elaborate switchboard equipment, power house installation and modulators necessary to handle sound recording.

Every bit of "juice" used on the soundproof stage comes from batteries. The regular line supply varies too much for the exceedingly fine work required of these machines.

Moving picture men admit that their big investments have only begun. They expect developments in the talkie industry that will mean the expenditure of additional millions for several years to come.

A section of the sound-proof building in which talking movies are filmed is shown above. The cameras shoot through the thick glass windows in the recess in the wall. In the booth above the camera the electrician shown in the close-up inset, adjusts the voice recording apparatus.

Building the Heath

By STEWART ROUSE

COMPLETE information is here given on the building of steel tube fuselages for light airplanes. Mr. Rouse takes the Heath Parasol as a specific example and tells how the jigs are laid out on your own floor. Details for modern light airplane motor mountings are clearly shown.

LAST issue, in January, we were just getting the fuselage laid out on the floor. Here is the diagram, all blue printed and everything, right on page 55, and it will explain better than text can what some of the points are we have been talking about. You will remember we were working right on the front part of the fuselage, and had just explained the 14 ga. plated wire which trussed the rear of the fuselage up.

This month we might as well go along in orderly progression and carry on step by step the details as we come to them. About that wire tightening job:

Tighten the wires until they sing a low note when picked. The method of locking turnbuckles against loosening is shown in Fig. 4-F. Remove the side from the jig, and make another side exactly like it except either a right or left side, as the case may be. To make the second side it will be necessary to borrow the sternpost of the first as only one sternpost is needed in the complete plane.

Now put in all the top and bottom horizontal struts following the drawings of individual fittings shown in Fig. 3 and Figs. 1 and 2, very carefully. Note that the wires that cross *inside* the fuselage are not fastened to the fittings, but are looped around the longerons. It requires two pins to bend these loops, one the size of the longeron and the other ¼" in diameter. Use the ferrule as before. Wherever two brace wires touch, apply a heavy wrapping of friction tape to prevent wear. The wires *inside* at EF are offset up as shown in Figs. 6 and 7, to allow foot room over the rudder bar. The fittings at F and K will require more care. There are two tie-rods at these points, one ¼" and the other 5/16". The ¼" one runs straight through from side to side holding a 16-gauge wing strut fitting on each end, and has 3 nuts, one

This is the Heath Spokane-Parasol as fitted with a 32 h. p. Bristol Cherub engine, the performance data of which was set forth in Part I. This plane was the forerunner of the high lift wing Sute-Parasol described in the above article.

"Super-Parasol" Plane

PART II
of a
Complete
How to Build
SERIES

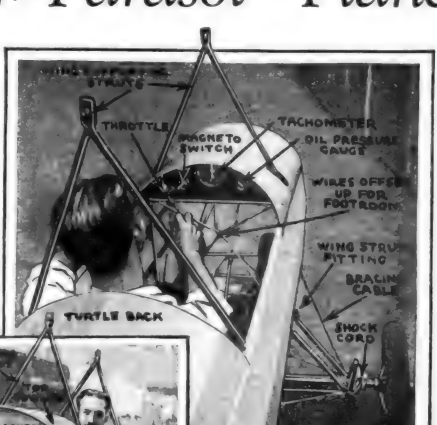


Fig. 2. Rear three-quarters view of the Super-Parasol showing the cockpit and the neat arrangement of the instruments on the thin mahogany panel.

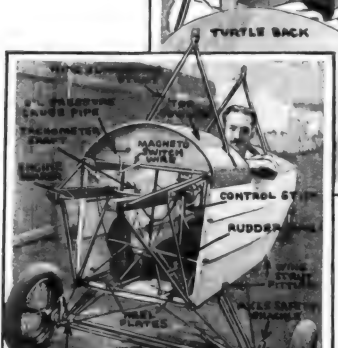
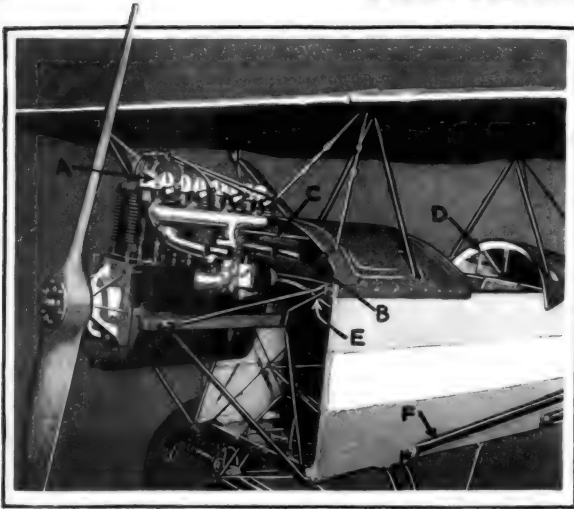


Fig. 1. This shows the front three-quarters view of the Super-Parasol fuselage and landing gear. Note that the pilot sits on the floor. The installation of the motor gives great rigidity to the motor mounting.

acting as a shim (see Fig. 3, K and F). The $\frac{1}{16}$" rod passes through the horizontal strut and carries a nut on the inner side of the longeron and one at the outer end to help hold the wing strut fitting. Veise rods should be of good, free-cutting steel, with the S. A. E. thread. All bolts should either be drilled for $\frac{1}{16}$" cotterpins, or riveted on the end to lock the nut on. All parts that will ever require dissembling must be cotterpinned.

With all struts and wires properly installed, and the wires in the sides already tightened properly in the jig, truing up the fuselage should not be difficult. Mark the center of each of the top horizontal struts. Stretch a strong string tightly between the stern post and the center mark of the front strut. Starting at the front, by tightening and loosening the top bracing wires of the



F, wing struts; D, turtleback bulkhead; A, cooling plugs; C, throttle rod; B, Heath exhaust stacks; E, gas line.

fuselage, finally bring all the center marks on the struts to the string. Then make the brace wires *inside* the fuselage of equal length in each bay. Then adjust the bottom wires. If the job has been done correctly, the fuselage will be true, and all wire will be in equal tension. The wires should be taut but *not* tight. They should hum a *low* note when picked.

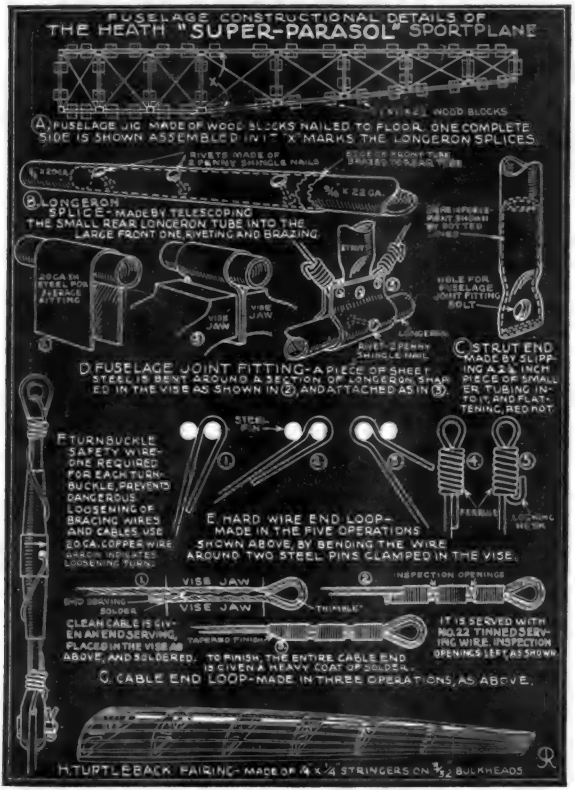
The Motor Mount

The motor mount should be easy after making the fuselage. Note that the tubing is 18-gauge instead of 20-gauge. Its construction is easily understood by a study of Figs. 3, 6, 9, 10. Work very accurately, and be sure and get the holes for the engine bolts drilled exactly right, through the engine beams.

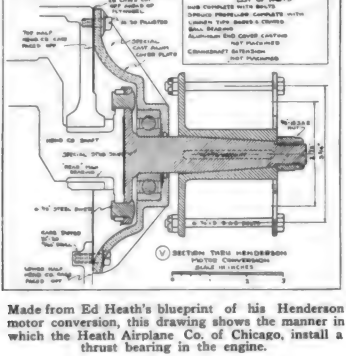
The Landing Gear

First, carefully study Figs. 1, 3-U, 5, 6, 7. Reenforce the tube ends for about 2½". The "U" shaped strap of sheet steel is to catch the axle in case the elastic cord breaks. The collar, with large washers brazed to its ends, which is riveted to the axe by a rivet made from an 8-penny nail passed through the collar and axle, is to keep the wheel, axle, and elastic properly spaced. The landing gear is braced with 3/32" hard stranded cable. The method of making a cable end is shown in Fig. 4-G. Have the cable perfectly clean where you wish to make the end. Use half-and-half solder. Use alum flux. Serve (wrap) the extreme end, with a temporary wrapping of No. 22 tinned serving wire, to prevent fraying out while handling. The length of the wrapping on the finished end should be 15 times

This Blueprint Shows Important Details of Construction



This blueprint shows the manner in which the floor jig is made, as referred to in this article and also in part one. The ingenious Heath method of making metal fittings, pinning them instead of employing welds on the thin tubing used for struts and longerons, is clearly shown. The method of making them is depicted by Mr. Rouse so that any one may understand.



Made from Ed Heath's blueprint of his Henderson motor conversion, this drawing shows the manner in which the Heath Airplane Co. of Chicago, install a thrust bearing in the engine.

the diameter of the cable. Lay it up in the vise with thimble in place as shown. Solder down one side to hold it together while being wrapped or served. Serve the end with No. 22 tinned serving wire, used double, leaving two inspection openings as shown in Fig. 4-G. When nearly through serving, remove the end serving and taper the extreme end, by raising the strands one at a time and filing them off, so that when service is completed, the cable end will look as in Fig. 4-G. Now finish by giving the entire cable end a heavy coating of solder, soaked in as much as possible. One end of the cable is attached to an aircraft clevis, and the other to the eye of a No. 326 turnbuckle. The clevis and the forward end of the turnbuckle are secured, respectively, to a regular clamp metal fitting on the longeron with a bolt, and to a lug on the landing gear with a clevis pin locked by a cotter pin.

The Wing Supporting Struts

The turnbuckle is secured with safety wire as shown in the drawing on page 55. Once secured in this manner it is safe.

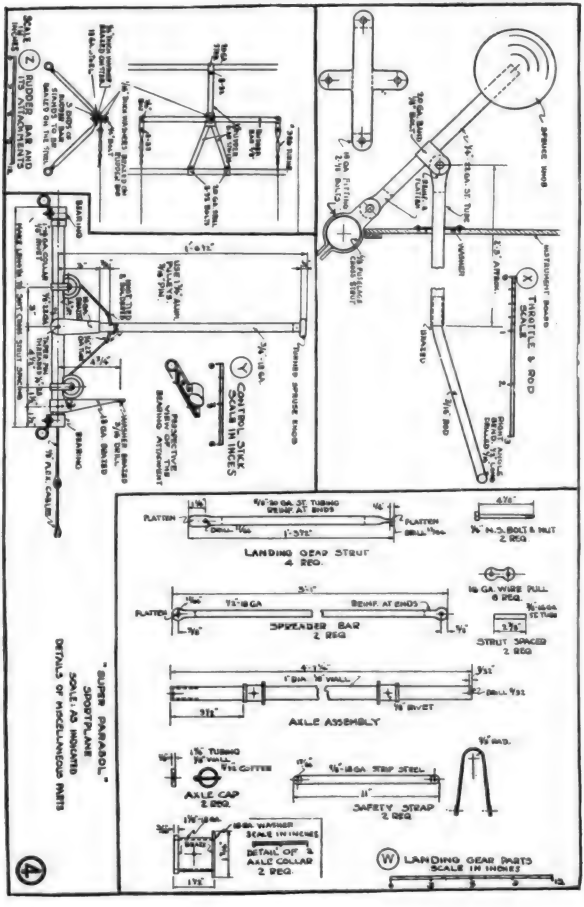
The wing supporting struts must be made with great accuracy (see Figs. 1, 3-E and J). They are each made of one tube reenforced for about 8" in the center, and 2¼" at the ends. Heat it in the center, squeeze it in the vise, and bend the struts to the correct angle. Measure carefully, and reenforce and flatten the ends. Cables are made as for the landing gear.

The tail skid is made as in the drawing (see Fig. 3-S). Bend it cold of cold-bending spring steel, one leaf at a time. Make the little clip for it, but do not clip it until after installation on the sternpost. Make it *no* taller than on the drawings.

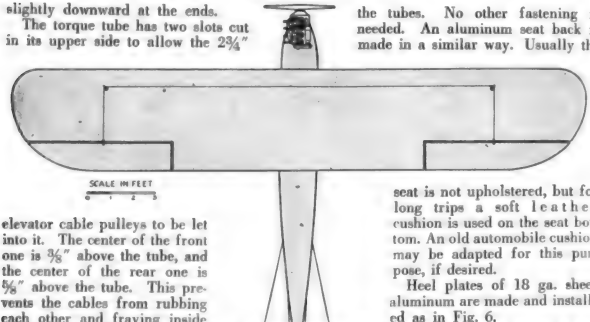
The drawings of the control stick and rudder bar are practically self-explanatory. Study Fig. 5-Z very carefully for details. Wherever any piece of steel is flattened it *must* have a generous reenforcement inside. The rudder bar has 1/16"x1" washers brazed to it in the middle, which act as bearings for the ¼" pivotal bolt which fastens it to the rudder bar stand. The rudder bar must be reenforced at the middle, with a 4" length of tube inside, held in place with a rivet. The stand or tripod is easy to make. The flattened upper ends are riveted and brazed to the under side of a piece of 18 ga. sheet steel, through which the pivotal bolt passes. The lower flattened ends are fastened to strap steel fittings wrapped around the horizontal struts D and F, and these fittings should be riveted to the struts.

Care should be used in using the vise to flatten and bend all metal as if it is bent too quickly strains will set up and weaken it.

The control stick is a ¾"x18 ga. steel tube. It has a turned spruce knob for its handle. At its lower end it has an 18 ga. steel plate brazed on each side, reaching somewhat beyond the lower end of the tube, forming a fork embracing the torque tube running fore and aft, and held to it by a ¼"x28 threaded taper pin passed through both fork and tube, allowing free fore and aft movement of the handle. A ⅛"x1" washer should be brazed to each side of the tube where the pin goes through. Just above the fork plates a ¼" hole is made and a short length of ¼"x22 ga. tube is passed through, brazed in place and bent


"SUPER PARABOL"
SPORTPLANE
SCALE: AS INDICATED
DETAILS OF MISCELLANEOUS PARTS
LANDING GEAR STRUT
4 REQ.
SPREADER BAR
2 REQ.
AXLE ASSEMBLY
AXLE CAP
2 REQ.
SAFETY STRAP
2 REQ.
DETAIL OF AXLE COLLAR
2 REQ.
LANDING GEAR PARTS
SCALE IN INCHES
THROTTLE & ROD
SCALE
CONTROL STICK
SCALE IN INCHES
RUDDER BAR AND ITS ATTACHMENTS
SCALE IN INCHES

New Wing Plan of the Heath Super-Parasol is Highly Efficient



slightly downward at the ends.

The torque tube has two slots cut in its upper side to allow the 2¾" elevator cable pulleys to be let into it. The center of the front one is ⅜" above the tube, and the center of the rear one is ⅝" above the tube. This prevents the cables from rubbing each other and fraying inside the tube. The pulleys are held in place by a pair of strap steel fittings, first brazed to the torque tube, and then drilled for the pulley axle bolts. A simple bearing is fitted to each end of the torque tube as shown, and the tube is held against slipping fore and aft, by a collar on the tube in front and by the face of the aileron operating lever at the rear. This lever is made of a "U" shaped 18 ga. sheet steel strap, bent about the torque tube, brazed and riveted. It has another 18 ga. plate brazed to its front edges to give it a channel section for stiffness. To the upper tip of this plate is brazed a washer to give a good bearing for the shackle, which holds the forks of the turnbuckles at the ends of the aileron control cables.

The Seat

The seat is made of a sheet of 20 ga. sheet aluminum (see Figs. 1 and 2). An extra horizontal strut is installed to support its front edge. Cut the sheet about 1⅞" larger all around than the rectangle formed by the new strut, the horizontal strut K, and the sections of longeron between H and K. Cut a good-sized triangle from each corner as in Fig. 2, and proceed to bend the edges of the aluminum closely around the tubes. No other fastening is needed. An aluminum seat back is made in a similar way. Usually the seat is not upholstered, but for long trips a soft leather cushion is used on the seat bottom. An old automobile cushion may be adapted for this purpose, if desired.

Heel plates of 18 ga. sheet aluminum are made and installed as in Fig. 6.

The instrument board, Figs. 5 and 7, is made of 3/32" plywood, stiffened by another piece of 3/32" plywood glued to its reverse side. This second piece is left solid wherever an instrument is to be installed, but is cut full of large holes everywhere else, except for a 5/16" edge around the entire instrument board. The instruments are set flush with the face of the board by cutting large holes through the board at the thick places provided, slipping in the instruments and fastening their flanges to the edges of the holes with small screw headed bolts. The board is held by a pair of metal clips wrapped around the horizontal strut E, and several small brackets fastened with tiny bolts to the aluminum cowling. The throttle is a simple matter and needs only the drawing (see Fig. 5) for explanation. Its lower end is clipped with a strap fitting to horizontal strut "E."

The Turtle Back Fairing

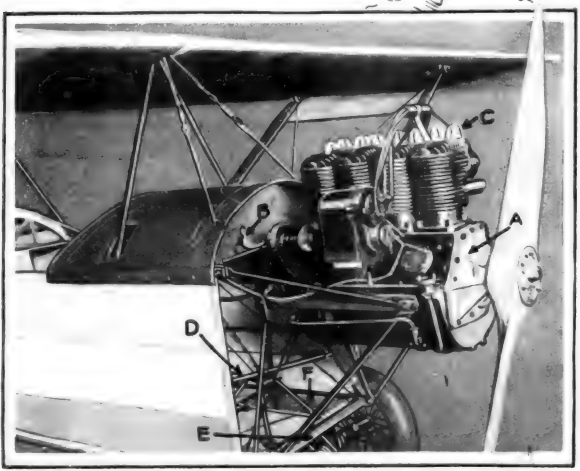
From point J to point T, the top of the fuselage when covered is flat. This in no way impairs the flying qualities. If, however, it is desired to have the plane perfectly conventional, a turtle back fairing can be added. This gives a rounded top to the

fuselage and continues the lines of the top cowling in front of the pilot, back to the tail. It is made of a series of thin plywood bulkheads each similar to an instrument board, spaced at about 18" intervals, from J to T, with ¼"x¼" stringers spaced about 2½" apart running fore and aft, glued and nailed in little notches in the edge of each bulkhead. The front bulkhead should be of the same size and shape as the instrument board, and each succeeding one should be smaller and less highly arched, until the last one, touching the front of the tail, which is a flat stick, with notches into which the ends of the stringers are glued and nailed flush with the upper surface. The outside ends of these bulkheads may be fastened to the top longerons either with ties of linen cord passed through holes in the bulkheads, wrapped around the longerons, and then saturated with wing dope; or by aluminum clips. (See Fig. 4-H.)

The Tail Group or Empennage

Make the tail surfaces with great care and accuracy, scaling them from Figs. 1 and 2. The rigid front half of the horizontal surfaces of the tail is known as the horizontal stabilizer. It has a front and rear spar, and two internal diagonal braces. The front spar is a piece of ½"x½" spruce slightly rounded on its front edge. The rear spar is a piece of ¾"x¾" spruce, beveled on its rear edge as shown. The ribs are each composed of two ⅛"x⅜" spruce cap strips.

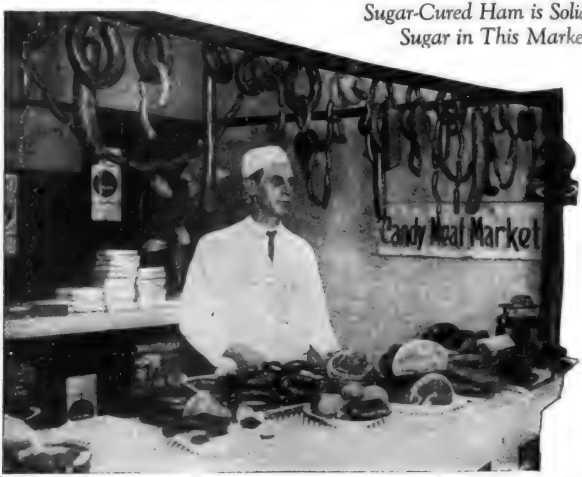
Well, that's all for this time! We will go on from here in next month's Modern Mechanics. The light airplanes editor has asked that if any questions present themselves to you that you wait until reading next month's article before writing.



An extremely clear closeup of the "business end" of the little ship. A, end cover plate. B, oil gauge pipe. C, aluminum air-cooling port plugs. D, rudder bar. E, wood nailer strut. F, heel plates.

Everything in this Meat Market is Made of Candy

Sugar-Cured Ham is Solid Sugar in This Market



ONE of the most unique candy stores in America is the "Candy Meat Market" which is run by Jim Crowe in the loop, Chicago. Here Mr. Crowe is seen posing for a photo in the midst of his candy meats.

Everything in the store, except the actual fixtures, is made of candy. So well are all the meats imitated that the hams smell of that salty tang that is so familiar to all of us. The summer sausage looks like summer sausage, but it isn't—it's candy. Not only does all the candy represent some form of meat but it is made to please the palate. At first, Chicago people doubted the reality of these confections, but time and taste have taught them that this store sells "quality goods."

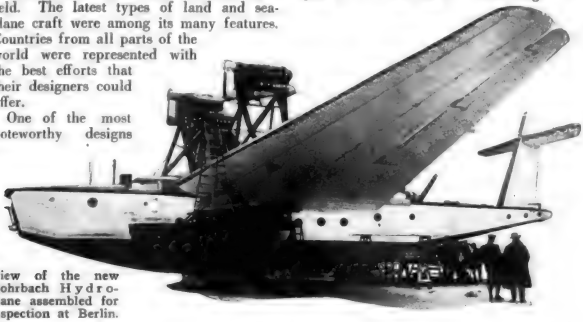
CRUDE OIL MOTORTRUCK IS TESTED

ROYAL Automobile Club tests are being run on this lorry fitted with a Mercedes-Benz crude oil motor. This engine is a German invention and is designed to run on crude oil. The lorry and trailer are shown here loaded to capacity.

New Trans-Atlantic Plane is Completed for Show

MANY interesting exhibits were on display at the International Aviation Show held in Berlin a short time ago. This show was reported to be the biggest exhibition of aircraft that has ever been held. The latest types of land and seaplane craft were among its many features. Countries from all parts of the world were represented with the best efforts that their designers could offer.

One of the most noteworthy designs was the Rohrbach Romar Hydroplane. This huge seaplane, carrying 17 passengers, was the center of constant interest because of its size and appointments. It has a wing span of 115 feet and is 77 feet long.

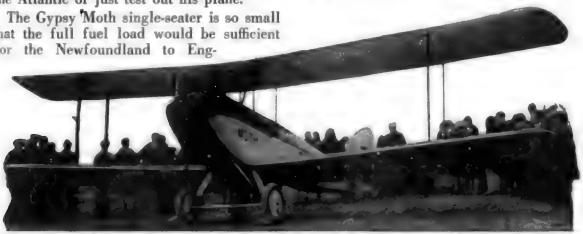


View of the new Rohrbach Hydroplane assembled for inspection at Berlin.

SMALL PLANE THAT ATTEMPTED ATLANTIC FLIGHT

WHILE waiting for weather conditions to prove favorable, Lieut. Commander H. C. McDonald of London kept secret his intention of flying the Atlantic. He was ready to jump off at the first sign of good weather. On Oct. 17th Lieut. McDonald took off with full load, but it was not certain whether he meant to continue across the Atlantic or just test out his plane.

The Gypsy Moth single-seater is so small that the full fuel load would be sufficient for the Newfoundland to England jump, if everything went well. The Moth is a very sturdy plane and could have taken McDonald across safely. Time has shown that McDonald never reached the goal that he started for so bravely and the world has marked up another name among those who have given their lives for the betterment of Aviation.



A close view of Lieut. McDonald's plane warming up before the start of its flight to Europe. By comparison with the huge Rohrbach the smallness of McDonald's plane can be realized.

How to Build An

by GILBERT MICKELSON

BUILT to travel a hundred miles an hour, this speedy sled can be used to test your converted aero engine! This article shows the way to build the frame and runners on which the converted engine may be mounted.

"SAY, Bob," said Jim Smith one still winter night as the two cronies were poring over plans for a sport airplane which they contemplated building, "Why not try out the motor we've converted on a *sled?*"

"What do you mean now, Jimmie?" queried his pal.

"Just this: We have a good motor here that we've converted from an old motorcycle engine. She has a thrust bearing in her, and has been frigged up inside like a Christmas tree. But do we know whether the job will hold together under full load such as she'll be pulling in an airplane? We do not. And suppose when we get this airy-ship of ours built and someone is test flying it the motor conks dead. Won't we feel nice?"

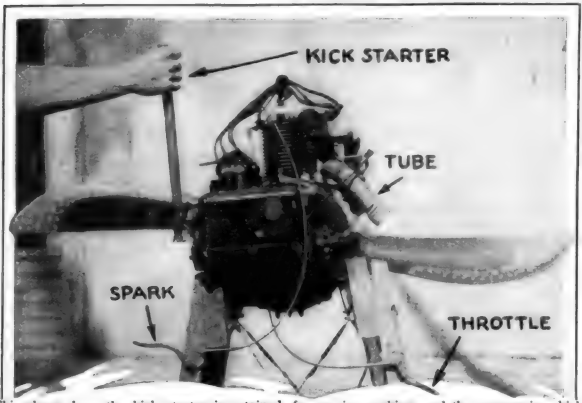
"You mean, won't I feel nice," laughed Bob. "I do the test flying, and if the motor conks it is my hard luck. Won't *we* feel bad? How do you get that way?"

"Aw, shucks!" Jim responded, "you know as well as I do that all you'd have to do would be to poke her nose for the field and glide in. Nobody but a rattled, modo novice would ever wreck a ship in a test flight over a home field! Get airwise, man, get the feel of things! You'd be O. K."

Bob grinned, for well he knew the truth of his chum's words. But the proposal was not yet aired. Curiosity piqued him.

"Well, I suppose you're going to suggest that we build a test stand and run the motor to death on the test stand. You ought to know better, Jim. You know that a propeller standing anchored to a test stand is de-

AERO ICE SLED



This shows how the kick starter is retained for use in cranking, and the manner in which the controls are mounted. Flexible tube carries off the exhaust.

veloping zero efficiency and that the motor is doing no real work except to beat up the surrounding air! A motor has to be moving to give itself and the prop a real honest injun workout."

"I know it. Listen. Why not build a test stand for our experimenting and mount it with a nacelle for a pilot and put the whole thing on runners like an iceboat. Then we could try her out on the lake and get the motor's bugs completely out of her so we could know what she'd do. Wouldn't have to wait till we got her up in the air to realize we didn't understand her. And you know, Bob, a single seater doesn't have a ghost instructor to tell you what to do and when. You've got to know your motor. We'd have a whale of a lot of fun and plenty of thrills. What do you say we do it?"

"Good. I'm game. What'll it cost and how fast will it go?"

Jim had figured out that the lumber, carriage bolts and blacksmith work would come to just about $10, and that about three full afternoons' work by the two of them would come to the end of the job with the exception of painting, which might take overnight if they used a quick drying red lacquer. Speeds up to a hundred "per" were promised.

"Here's the lumber," spoke Bob the next afternoon as his friend in crime dropped in after classes had closed for the day. "Get a saw and get busy."

Jim cut off two two-by-fours to the required length as shown in the drawing which he had prepared. Next he cut to length the oak and fir for the runners.

When the runner beam and the two-by-four backbone pieces and the runners had been cut to length, Jim took the two-by-sixes in hand and cut the engine stringers and forward strut supports which slanted a bit to take the thrust of the propeller. Piece by piece he cut the raw lumber to within a shade of the length required and handed the pieces over to Bob, who was as handy

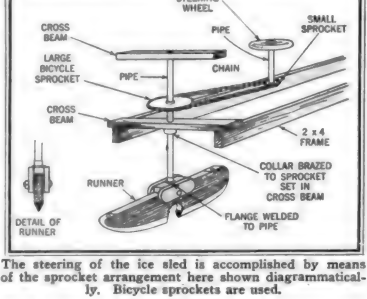
Blacksmith's and Lumberman's Bills Total Only $10 for this Sled

with a drawknife as Jim was with his mathematics.

"First, we'll get the runners cut to shape and have the blacksmith put to work on getting the iron on 'em," muttered Bob as he shaped each to a paper pattern tacked on the side while the vise held the wood from the tugging effort of the drawknife.

"Good idea," and Jim clamped the two-by-four backbone sticks together, and, marking them for bolt holes, drilled the scant quarter inch hole for the long-thread iron rods to pass through.

The runner beam was carefully turned over to Bob after the marking and laying out had been done, as well as the drilling, by Jim. Bob put a gloss finish on the fine old piece of fir, rounding the nubbin or outboard ends nicely and carefully squaring lines across the bottom where the runner cheek pieces would be bolted.



The steering of the ice sled is accomplished by means of the sprocket arrangement here shown diagrammatically. Bicycle sprockets are used.

In the meantime, time had gone by and a full afternoon was almost spent. The boys decided it was high time to instruct the blacksmith just what they wanted in the way of iron, so they took the completely cut runners to old Lars the blacksmith, and laid down the law to the twinkle-eyed old Norwegian.

"Upset the middle of a piece of 3/8 by 1 7/8 inch strap, Lars," said Jim, "and vee it along the bottom. Then flatten the ends so they will curl over the fore and rear end of the runner where heavy lag screws can be bored in. And say, countersink the vee a bit so that we can get thick brass screws into the bottoms to hold the iron to the runner block."

Going on to explain, Jim outlined the best way to make the control column for steering was to use pipe—gas pipe—and braze, or preferably weld, a flat flange to the bottom end of the forward runner pipe, letting it pass through, welded, to the small large sprocket end of a bicycle sprocket sans pedals. Around this sprocket was to pass the usual bicycle chain, and mounted on oak pillow blocks back in the pilot's nacelle was to be a second parallel gas pipe, free to turn as the forward one, on which a Ford steering wheel and a small sprocket had been welded. This, Jim explained, would give the helmsman leverage and about the same power over control as one could feel in a car.

Further, he explained to Lars that the front steering runner had more of the blade behind the fulcrum than in front of it, so that the blade would tend to trail and not tend to get bossy and steer the speedy craft every which way.

Lars nodded and said his bill would be $5.00, and as Jim's lumber bill had been $5.00, he knew his estimate had been right.

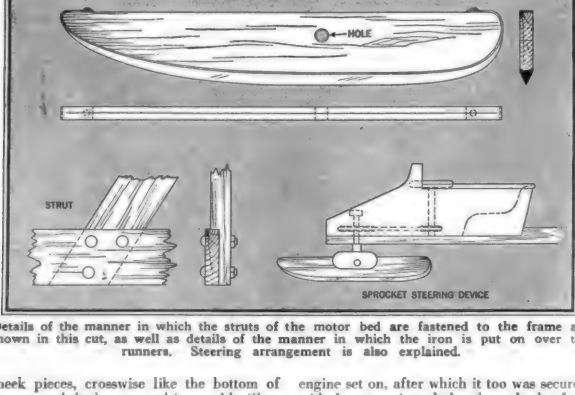
With classes over the following day, Bob and Jim were together again, busily assembling the members of the ice craft.

The runner beam was placed across two boxes, and the backbone pieces bolted in place. Then the cross pieces in the front were secured with angle irons and bolts. The pillow block for the front runner was fastened in, and then the frame of the nacelle was put on.

This was 2 by 2 white pine, over which ordinary beaded fir ceiling was nailed. The front of the "bathtub," as Bob was wont to call it, was given a rake and a flare near the top to deflect the cold winds upward. The bottom was nailed across, inside of

Follow These Dimensions in Building Your Ice Sled

Detailed blueprint giving major measurements of the 100 mile an hour aero ice sled. Bill of materials gives the sizes of the various members of the sled, and the disposition of the tank and minor details are shown plainly in the several views. A scale is included.



Details of the manner in which the struts of the motor bed are fastened to the frame are shown in this cut, as well as details of the manner in which the iron is put on over the runners. Steering arrangement is also explained.

cheek pieces, crosswise like the bottom of a scow, and the boys tossed in an old pillow for a seat. The leg room was just enough for both to sit, one sitting up in the lap of the other while the other steered. The pillow blocks for the steering apparatus were put in, and then the rear end called for their attention.

The forward struts of the engine mounting were canted forwards at the bottom and rearwards at the top so as to take the thrust strains of the propeller. The boys remodeled the very popular Henderson motorcycle engine, and had left the usual front flywheel end so that the transmission could be used by substituting a spare upper and lower base, since the propeller thrust conversion was an added feature placed on the starting crank end of the motor.

"We'd better get this guy wired up like a Jenny fuselage," suggested Jim, the technician. "The grain of the wood might be weak and the bolts might split if we would hit a snow drift, so let's play safe and guy it up so that the worst it can do is get badly bent."

"Your head works as quick as ever," was all the other could answer, as he was busy boring the holes for the rear strut mounting.

The engine beds were bolted on, and the engine set on, after which it too was secured with long carriage bolts through the four lugs.

"You see," commented Bob, "the starting handle is a good feature. You can leave it on and be safe in this kind of an installation. No man ought to try to crank a prop up while he is standing on ice. A quick pull on this rig and the job is whirled over so fast she has to start!"

"We can get her tuned up and strip the big base for the smaller one later," assented Jim. "The flywheel and gear box are valuable and ought to be saved. So we are playing common sense when we decide to rig her this way."

The turnbuckles on the bracing were made tight after the motor was placed and the frame had absorbed natural sag. The tightening was just enough to stiffen the wires and make them twang when plucked.

The nacelle having been finished, and the engine mounted, there remained but the problem of the controls, the gas supply and the installing of the runners preparing for a trial trip. The boys were excited with the prospects of giving their conversion a real "under actual conditions" tryout.

Jim decided that the controls had best be the old motorcycle controls of Bowden flex-

ible wire, which they would attach to the forward struts of the motor mounting. Bob agreed that such a mounting offered as good as any, and grumbled just a little because they were not long enough to reach to the forward side of the steering wheel, where his methodical mind would have naturally placed them.

Suddenly, while musing about the problem of the not-so-ideal placing of the controls, Bob asked dryly what they should do about feeding the motor gasoline.

"How about a gas tank!" he asked of Jim.

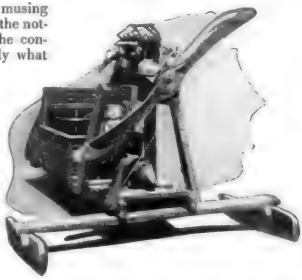
"Use the tank on an old crippled junk motorcycle, and use a battery of about four to six volts to an Autopulse to get the gas to the Zenith," was his somewhat sarcastic comeback.

Bob had surmised some such expedient before his partner had finished talking, and had ripped an old tank from under the pile of workbench debris, and was now already pumping up the blowtorch in readiness to solder the tank tight.

"That means a switch in the dashboard and everything, doesn't it?" shot Bob, whose mind was now appeased at the thought of having an instrument or two where he thought they should be.

Two blocks were placed across the backbone, to which strip brass saddles were fastened, and the tank was clamped by them after having been slid into place directly underneath the motor. A copper tube from a Ford car was adapted with nipples to connect the Autopulse and the tank and Zenith carburetor with which the Henderson engines come equipped.

Bob tested the Autopulse and at the first throw of the switch the carburetor primed, flooded and all was ready for starting.



A photo taken from the "business end" of the ice sled after Jim and Bob had completed it. Note the copper tipped propeller. The copper on the tips is furnished by the maker of the propeller and protects against wear by snow.

"They're a great thing, these little electric gas pumps," he said. "Wouldn't be without one."

"You couldn't be and get the gas up there unless you used a vacuum tank," interposed Jim. "Second hand vacuum tanks with any moisture in 'em will freeze solid out where we are going to use this sled."

Lars appeared in the door with the iron work, and before the two cronies had turned in that night the actual cutting and fitting had been done and the simple sled had been assembled, ready for paint, propeller and gas for her trial run.

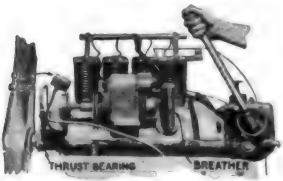
Next morning Jim called a drayman, and the sled was hauled to a lake where the February winds had swept a seven mile stretch clear of snow, and King Winter had frozen a hard smooth surface, ideal for motor sledding on the ice. There was no wind. Jim acknowledged the fact when Bob spoke of it.

"Good. Then we can go as fast one way as the other. But to get real speed you've got to have a forty mile wind blowing the same way that a 100 mile ice boat is going. Then you have 140 miles an hour and all you can do to keep alive!"

The runners were finally bolted into place on the swivels, washers being placed in the proper places to prevent lateral weaving, and the propeller was bolted on.

Bob hooked up the ignition wires, surveyed the far expanse of glistening ice in the bright morning 10 o'clock sun, and shuddered involuntarily.

"It's a long walk across there," he whispered to himself. Mentally he had a treat in store, for shortly they were to be flicking across a patch of rubble ice in a second's time as they flew, or rather drifted like a wraith, over the distance.



The thrust bearing has oil piped to it, and the kick starter was left on before final conversion.

The wires were hooked up. The Autopulse started, Jim stood at the controls while Bob squatted down under the hood of the nacelle with the wheel between his legs in his lap.

"Contact!" called Jim, as he gave the kick starter a vigorous jerk. The motor reliably coughed, caught on, and revved up mildly as Jim watched with satisfaction the oil begin to flow and noted that the crankcase was beginning to warm. Climbing in he called to his mate.

"Ready?"

"Let 'er buck," shrilled Bob above the flashing, willing roar of the little engine. "Give 'er the gun; let's go."

Jim reached around and opened the magneto advance and the throttle. The sled sprang to life, gathered way slowly, then fairly flew, gaining momentum with each yard of streaking ice.

The few men who had helped to assemble the red racer on the ice stood as the aero sled clicked across the ice getting started, and then whistled in admiration as they saw it, carrying two, gather headway until it seemed as though it were a part of the wind itself, moving at unbelievable speed across the ice.

The return trip was slower. As the sled came into sight again, homeward bound, the motor was missing badly and the sled was not making great speed. Finally with much coughing it negotiated the haven it had recently departed.

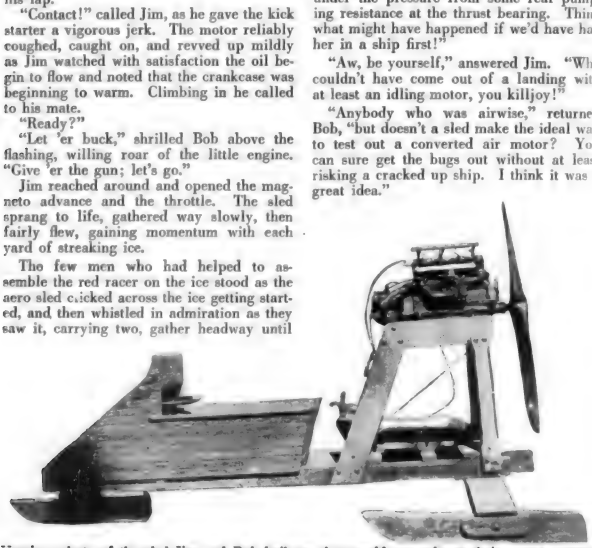
Jim and Bob stepped out and looked at each other.

"I never went so fast in my life, or so far in such little time!" Jim's enthusiasm knew no bounds.

"Yes," replied Bob, "but think where one of us had been if we hadn't built an aero sled to give the motor the realest kind of a real workout. That oil line broke under the pressure from some real pumping resistance at the thrust bearing. Think what might have happened if we'd have had her in a ship first!"

"Aw, be yourself," answered Jim. "Who couldn't have come out of a landing with at least an idling motor, you killjoy!"

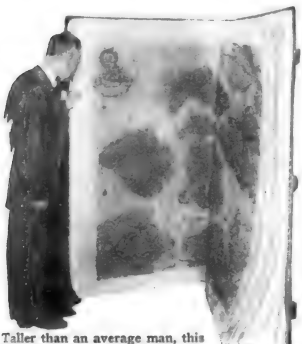
"Anybody who was airwise," returned Bob, "but doesn't a sled make the ideal way to test out a converted air motor? You can sure get the bugs out without at least risking a cracked up ship. I think it was a great idea."



Here's a photo of the sled Jim and Bob built so they could ground-test their motor conversion. The disposition of the various parts is clearly shown in this interesting view.

BOOKS in Postage Stamp and Billboard Sizes!

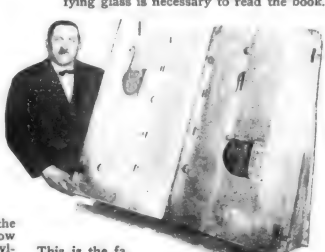
WHETHER you want a book that you can carry around in a thimble, or one which requires a truck to move about, you can find what you are looking for in the great libraries of the world. The pictures on this page show some of the Davids and Goliaths of the book world.



Taller than an average man, this huge atlas is more than 400 years old, dating from the 16th century. It is housed in the University of Rostock, Germany. The man in the picture is studying a map of the world as it was known to scholars of the middle ages. Note the hinges for clasping the book shut when not in use.

A postage stamp is larger than the copy of the New Testament shown above lying in the palm of its owner, G. A. Wiltsher of Hereford, England. The Testament is printed on Oxford India paper and is the smallest copy of the Bible in existence. It is kept in the midget book case shown alongside the postage stamp. A magnifying glass is necessary to read the book.

These two tiny books were found in the ruins of Umma in Babylonia, and are now in the library of the University of Pennsylvania. The morocco bound volume contains 29 pages and is ½ by ¾ inches wide. The cuneiform tablet is an invoice for three lambs which was written in the year 2350 B. C. The tiny size of the objects is shown in comparison with the fingers of the man holding them.



This is the famous "Devil's Bible" now in the Royal Library at Stockholm, Sweden. It was written in the year 1200 in the convent of Podlazics, Bohemia, and came into the hands of the Swedes when they captured Prague. The pages are a yard high and half a yard wide.

Berlin Installs First Stamp Vending Machine

BERLIN postal authorities have adopted a new invention that promises to be of real help to all. The automatic stamp vending machine which can be attached to trolley wire posts will relieve a long felt need. The photograph shows a customer operating the crank that produces the stamps. How many times have letters been written, only to be carried in the pocket because there was no stamp with which to post it! The Berlin idea is very simple. They plan to place a vending machine near every postal box in the city. The vending machine in itself is not new, but this application is novel. The machine is simple in construction. The stamps are manufactured on rolls by the printing house. These rolls fit into the machine. A magnetic coin tester unlocks the crank when a coin has been placed in the slot. The crank then turns out the number of stamps that the machine is prescribed to deliver.

American drug stores have been the principal users of the stamp vender.

NEW SCALP EXERCISER IS DRIVEN BY ELECTRICITY

BALDNESS seems to be the fear of all men. Here is the newest remedy for that fear. The new motor-driven scalp exerciser is guaranteed to give the scalp all the exercise that it needs. Scientifically the principle that this machine exemplifies is correct. Since blood is the food on which all the tissues of the body feed, the supply must be kept fresh and plentiful. Exercise will draw the blood to that portion of the body that is being so developed. The scalp does not receive sufficient exercise to warrant the growth of hair and as a result baldness ensues. To overcome this condition, the use of hair tonics became common. The chief value of any tonic is the process of application. The rubbing that is always prescribed makes the blood circulate and thus helps the hair gain new life. It was found that the hand could not deliver as much exercise as was really necessary, so the inventor of the scalp exerciser got busy. His machine possesses four rubber pads that are comparable to the human fingers. The motor is at the top and by means of vibrating rods causes the pads to move, which action exercises the scalp.

This new scalp exercising machine is designed to promote hair growth.

New Double Propeller May Revolutionize Flying

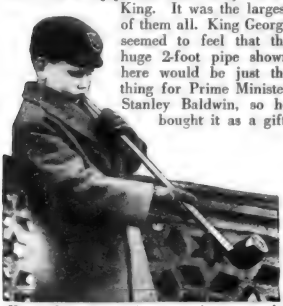
APPLICATION of a new principle in motor design has been worked out by Howard Wagle and Peter de Michlis of San Francisco. After nearly three years of labor they have patented their invention. They are installing the first dual motor in a Travelair Biplane, which D. C. Warren, well-known San Francisco flier, will demonstrate. The invention is a motor that has dual drive shafts, one within the other, revolving in opposite directions. Dual propellers are mounted four inches from each other and revolve in opposite directions. This counter direction, the inventors state, absolutely eliminates torque. The two blades compensate and the torque of each is dampened. The inventors claim that this new motor will pull a plane "straight up" and give it unheard-of speed. The principle that this new invention heralds is sound in theory and if the invention turns out as expected it will be revolutionary in aeronautical circles. Airplane makers are interestedly awaiting the flight test of the novel motor.

Peter de Michlis and Mrs. Howard Wagle are here shown with the double propeller which is to be tested soon.

KING GEORGE BUYS PIPE

WHEN the King and Queen visited the British Industries Fair in London, His Majesty was extremely interested in a tray of pipes.

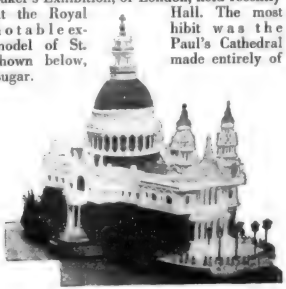
There were pipes of all sizes and kinds. There was one pipe that took the eye of the King. It was the largest of them all. King George seemed to feel that the huge 2-foot pipe shown here would be just the thing for Prime Minister Stanley Baldwin, so he bought it as a gift.



Young English lad is attempting to smoke the pipe that King George purchased for England's Prime Minister.

CHURCH MODEL BUILT OF SUGAR

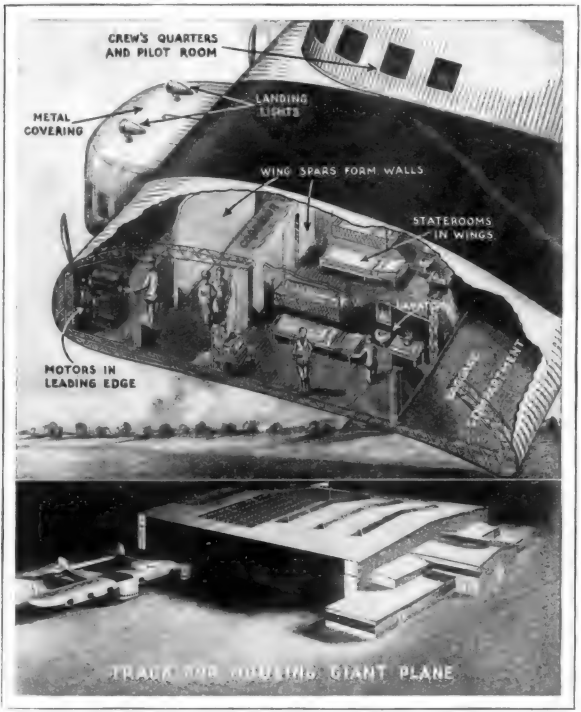
MANY novel sights were on exhibition at the 32nd Annual Confectioners' and Baker's Exhibition, of London, held recently at the Royal Hall. The most notable exhibit was the model of St. Paul's Cathedral shown below, made entirely of sugar.



RUMPLER Designs

Herr Rumpler, famous designer of Germany's war time fighting planes, is turning his peace time activities to good account in developing the world's largest airplanes. Rumpler, shown above in a characteristic pose at his drafting board, is now building an enormous monoplane which will have wings large enough to place staterooms in. A new blunt-nosed wing section is used to effect this design. Huge wheels, 10 feet in diameter, will be used on the landing gear. All motors will be easily accessible in flight. Navigating quarters will be in a cabin atop the wing.

Largest PLANE



The new Rumpler monoplane, now nearing completion in Germany, will have a span of 300 feet and a chord of 50 feet. It will be so large that space between the sides of each wing spar will be used for hallways, staterooms and motor compartments. A specially designed, power operated air field railway track will be constructed for housing the new giant. The cross section drawing shows the disposition of the arrangement. The plane will cruise at 82 m. p. h. A gigantic hangar is shown in the photo below with the big ship on the track. Note room for two of these monsters.

New Advertising Medium Displays Real Goods

LOS ANGELES is the home of many unique advertising attractions. One of its more enterprising concerns conceived the idea of a sign board that would be an architectural beauty. It was to take the form of a picture frame with the subject acting as the picture. A large wood frame was erected, plate glass fitted and the sign was ready.

A beautiful roadster was placed on the platform behind the window. The back-drop was painted so as to give the car a proper setting, the colored lights were adjusted and the picture was completed. The new picture-sign board has been declared the acme of out-door advertising.

Los Angeles advertising firm creates a new sign board that looks like a painting, but it isn't—it's a real car.

HERE'S AN EYE OPENER FOR YOU!

Miss Carmen Morales is demonstrating the manner in which this instrument removes metallic particles from the eye.

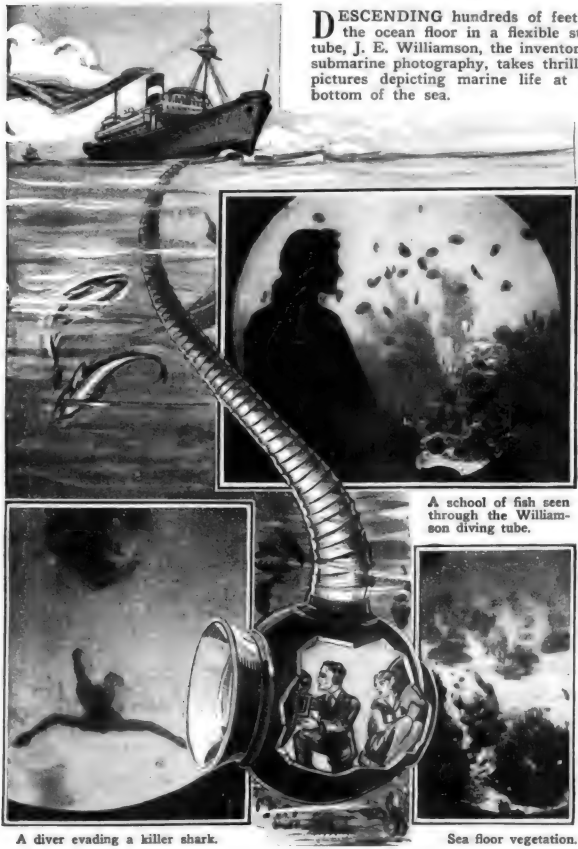
THE Electrical Show recently held in the Grand Central Palace, New York City, presented showings of several very novel electrical devices. One of the most practical inventions was a magnetic instrument for removing metallic particles from the human eye.

The human optic is very delicate and must be freed from any bit of lodged matter at once. If chips are allowed to remain within the eyelid they work into the eye-ball and nearly always cause blindness.

This machine has at last answered the cry for a painless method of removing metallic deposits from the eye easily.

UNDERSEA *Picture-Making*

DESCENDING hundreds of feet to the ocean floor in a flexible steel tube, J. E. Williamson, the inventor of submarine photography, takes thrilling pictures depicting marine life at the bottom of the sea.



A school of fish seen through the Williamson diving tube.

A diver evading a killer shark.

Sea floor vegetation.

How Fast can Man TRAVEL?

Is there a limit to the speed which the human body can withstand? Five miles a minute caused no ill effects for the English aviator who recently attained this speed.

RECENTLY broken records for speed in various methods of transportation have bettered the marks of recent years by such a wide margin that scientists are asking the question, "How fast can man travel before the functions of his body cease to be normal? Is there a limit?"

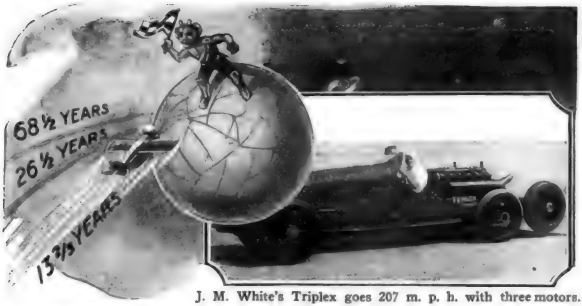
For many years the standard American idea of "fast going" has been travel on the 20th Century Limited. This train travels the 1,500 odd miles between New York and Chicago in 20 hours. The average running speed is reputed to be in the neighborhood of 80 miles an hour.

But, in methods of transportation, there is a new era at hand.

The nation is becoming airminded rapidly, and is accepting the airplane and the new type motorbus as the coming common conveyors. The reason is summed up in the one word, *speed!*

Tomorrow the 20th Century will be considered slow. New machines synonymous with speed will have come into common usage. How fast will they go? How much faster will they be than present modes of

The 20th Century Limited, crack flyer of the New York Central run between Chicago and New York, can run 80 miles an hour. Yet at this speed it would require 68½ years to reach Mars. Compare this speed with that of D'Arcy Grieg's seaplane—319 m. p. h.!



J. M. White's Triplex goes 207 m. p. h. with three motors.

travel? And how much of the speed which these machines have at their command can be utilized for moving human beings?

That is the purpose of recent speed trials in which new automotive and aeronautical records have been shattered. Much has been learned.

For instance, the recent rivalry for the world's automobile speed record between Malcolm Campbell, Frank Lockhart, and J. M. White produced the knowledge that man can travel at 211 miles an hour without suffering any ill effects. Neither nausea, faintness, nor mental aberration were noticed. It has been assumed that most normal human beings could travel comfortably at such speeds for prolonged periods without suffering.

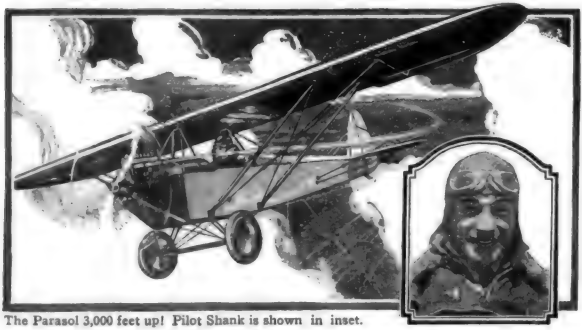
D'Arcy Greig, English ace, recently flew his Supermarine-Napier seaplane at an *average* speed of 319.57 m. p. h.

Just how fast are the speeds of these machines in relation to each other? The 20th Century, traveling to Mars, would take 68½ years. J. M. White's Triplex could make the 40,000,000-mile trip in 26½ years. D'Arcy Greig would be there in 13⅔ years!

The World's Fastest Traveler

Lieut. D'Arcy Greig

The Supermarine-Napier seaplane in which Lieutenant D'Arcy Greig attained the enormous average speed of 319 m. p. h., or better than 5 miles per minute.



The Parasol 3,000 feet up! Pilot Shank is shown in inset.

ALL the questions concerning housing and care of the light airplane are covered in this article by Gene Shank, who operates his own airfield. He tells how to check up the ship before taking off.

Caring for the "PARASOL"

By PILOT GENE SHANK

SOMETHING tells me that you members of the Hangar Gang ought to stay out of the air in weather like this. Soon the chilly winds of winter will be setting in and it won't be safe for greenhorns to play with a ship out on the field. Too apt to ground crash the old wagon if one of the gusts picks up a wing and flops her over!

So what do you say we go over some of the points in the care of the ship? No airplane can be any better than her pilot keeps her, and believe me there are plenty of old apple crates flying today which will one day part company with their various parts over some clean little town. Then the city dads will have to vote an appropriation to clean up the town with. Good care is essential to safe flying. Fliers with the most hours are always the men who put in the most time on the ground shining and polishing and checking their wind wagons.

Take this question of hangars, for instance. Sure! The ship should have a hangar! That is what hangars are for. Otherwise there would be no hangars. But it need not be elaborate, nor especially weatherproof. The main idea in keeping the ship in the hangar is to shelter it from the ravages of wind, and to a certain degree to protect it from changes in the weather which tend to make the wooden parts weak.

Excessive dryness of climate, or excessive dampness, will cause the wooden parts to alternately shrink and swell, and this of course is beyond control. The alternate loosening of the wooden members of any ship will eventually loosen the fastenings and will weather the glue so that it has but a fraction of its original holding power left. The object of the hangar is to shelter the plane and minimize the effects of the more severe aspects of the weather.

At that, there are many old ships out on many fields which have stood tethered to stakes for year in and year out and which have still flown when the motor could be started—but they are just the kind of ships the City Dads worry about. Weather does not feaze 'em as bad as you'd think.

A good hangar can be made for the Heath Parasol which is but very little larger than a dog-house. Since the wings of the Heath are readily demountable, as I understand it, the ship can be housed in a space about 18 feet long, 6 to 7 feet high, and about 6 feet wide. There is no need for a house which will accommodate the wings as set up, though it is a very desirable adjunct if you can afford it. For day in and day out flying such a hangar is of course a necessity. Most flying fields will allow you to tuck the Parasol to sleep under one of their larger ships for a nominal sum each month. But if you are doing only a few days' flying every season, house the ship in a small "piano box" hangar and dismantle the wings. It is the cheapest solution to the problem.

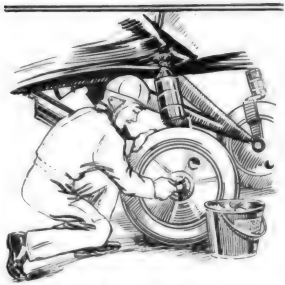
When the ship is left out on the field an occasional flurry of rain will not damage it more than to dull its finish. The engine, however, as well as the prop ought to be protected by a canvas jacket such as is shown in the illustration. These can be made in the form of sacks, and can have purse strings along the bottom edges so they may be drawn tight about the things they cover.

They may be folded while in flight so as to form the seat. You know in a Parasol, because the fuselage is so small, the pilot sits on an aluminum floor. These canvas covers might be made to serve the function of seat.

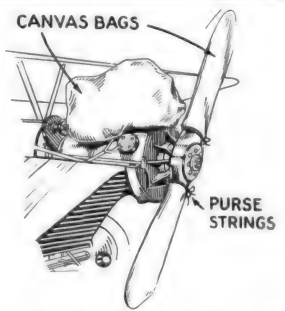
In any check-up, the motor comes in for the most attention. It is best to organize a definite system and routine method of checking up the motor, and adhere to it until it becomes a habit. Then there will be but the slightest chance that you will ever go haywire in overlooking any vital point. A system I use is as follows:

I check the prop first, then go right on down the line with every little point.

The propeller should be clean and well polished. Any splinters or cracks in the blade may result disastrously. Unless both blades are absolutely sound, flight should not be attempted.



The careful pilot always gives his undercarriage plenty of attention, checking the greasing and degree of tire inflation himself.



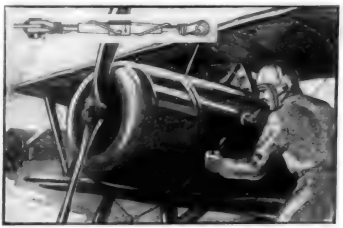
Canvas hoods with purse strings around the bottoms make ideal engine and prop blade covers. These can be folded and stowed to serve as the cushion.

See that the bolts in the hub assembly are snug and all the nuts and cotterpins are in place. After a prop has been in use for some time the flange plates generally compress the wood and the propeller may be loose in the hub. Another point to make sure of is that there is no lost motion be-

Fuel Lines, Landing Gear, Flying Wires are Main Items to be Checked

tween the hub and the shaft. This may be determined by seeing whether the propeller will "wabble" any if you grasp each blade in either hand and jiggle the blades from side to side.

Next see that the external oil lines are all tight and have no play. If you are using a water-cooled job, as with some Ford powered planes, be sure that water connections are tight. On the Heath Parasol there is no need for this as the ship is air-cooled. You should have some method of checking the amount of oil in the sump of the motor so you know you have a full supply.



Turnbuckles are safetied with soft copper wire. The proper tension of the flying wires can be determined by twanging the wires between thumb and forefinger.

Next check the fuel induction system, which means gas tank, gas line, carburetor, and manifold. Any slight looseness in this system is apt to prove fatal. The gasoline will drip from any loose coupling and your supply may be lower than you think it is at a time when the amount of fuel remaining is a factor in judging your flight.

On the manifold, especially with an air-cooled engine, you will have to pay particular attention to the gaskets. An air leak occurring even as small as a pin will make the motor run hot and will burn valves. If the fuel system is a gravity feed, be sure that the vent in the tank is open. With all mechanical parts of the engine tested, it is well to start the engine and run it slowly. Make sure that it is firing on all cylinders, then speed it up to be sure that it packs that "wallop" which is so vital to snappy performance.

The magneto should come in for its share of attention and also the wiring. Ground running will generally bring out weaknesses here. It is, of course, assumed that the plugs are cleaned after every flight.

The next item in this system of mine is to thoroughly check all control horns, flying wires, and cables. The flying wires should be tight enough to take up all slack and yet should not be so tight as to "sing" when snapped. The illustration shows the method of picking the wires between the thumb and forefinger and whanging them for tension. The landing gear is also important and particularly should every pilot make sure of the condition in which the wheel assembly is maintained. Generous greasing, frequent cleaning, and the daily double "O" on all spokes, shock absorbers, struts, sockets, terminals, nuts, and bolts should be kept.

It is a wise stunt to keep a memorandum of dates showing the details which were checked and upon what day they were last gone over. The human mind is extremely fallible, and some point which you thought you had checked you may discover to have "gone by the boards" when it is too late and you are in the air.

One of the fundamentals of the flying game is regular ship overhaul, and in the case of the Parasol, I do not think these heavily loaded little coffee mills should be asked to do more than ten hours without regrinding valves, or more than fifty without a complete overhaul all around. It is necessary to safety that all the points of possible trouble be regularly looked over.

Then with all these nominal points of possible failure checked a pilot can take his ship into the air with that certain cocky assurance of knowing he is coming home again.

Painstaking forethought is what makes good aviators! You'll get a whole lot more service out of your ship if you follow these simple hints of mine.

Medals Pay Debts of Amundsen, Dean of Explorers

WHILE the world waited for news of the lost Nobile fliers, Captain Roald Amundsen was organizing a searching party to fly to Nobile's rescue. Four brave men answered Amundsen's call. They fueled the French plane Latham-47 and took off from Tromsoe, Norway, shortly after S. O. S. calls had been received from the Italia. This was the last ever seen of the rescuers. The photo shows Amundsen just before he entered the plane on the fatal flight. It is the last picture taken of the man who has been acclaimed the greatest of polar explorers.

Recently, following the recovery of wreckage of Amundsen's plane, the medals which the explorer had accumulated during his lifetime were purchased by a philanthropist, the proceeds paying off Amundsen's personal debts.

YOUTH WINS LOG ROLLING CHAMPIONSHIP

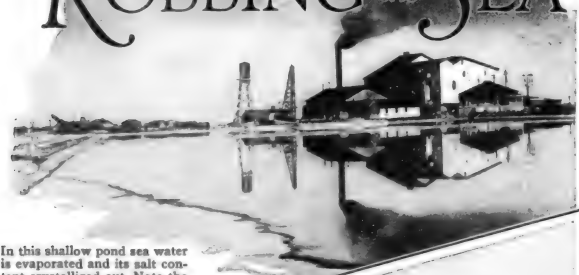
THE champion log-roller of the United States is Wilbur Marx, who won first place in the national contest at Washburn, Wis. Log rolling has been a great sport among loggers for many years. Each year expert log rollers gather at some appropriate place and in contest pick a champion.

The judges pick the logs that are to be used and each one is marked for size. Different log sizes are used for varying events. This method of log marking makes uniform judging possible and gives the contestants equal chances.

This young man, shown in the photo, is the youngest champion that log rolling has ever proclaimed. Young Marx not only exhibited great ability in the actual trials but was able to outshine all the entrants.

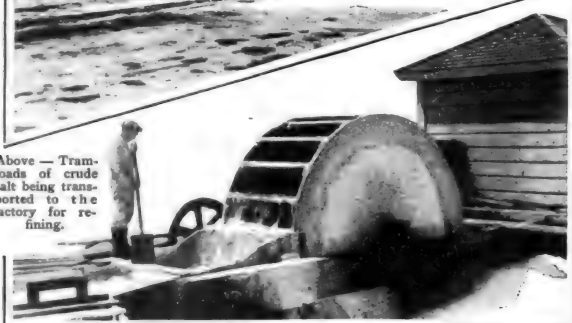
Wilbur Marx is shown above standing on his head while a partner balances the log. Log rolling is not easy. Try it sometime just for fun!

ROBBING the SEA



In this shallow pond sea water is evaporated and its salt content crystallized out. Note the ridges of salt along the edges of the pond.

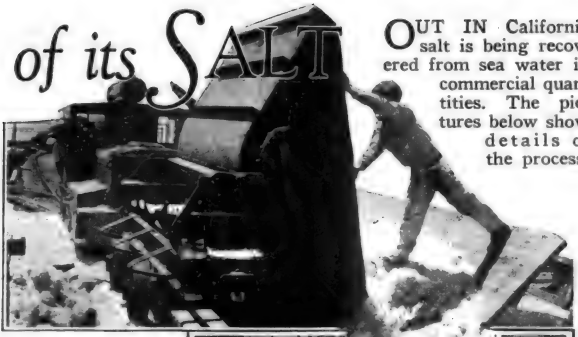
Above — Tramloads of crude salt being transported to the factory for refining.



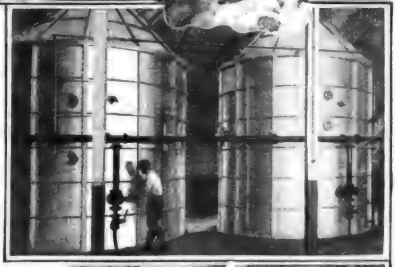
This paddle wheel, turned by electric power, is part of the pumping system which handles the salt-charged sea water. Pacific ocean water contains 4 per cent of salt in solution. In Russia and other countries much sea-water salt is produced, but much of the American product is mined in an almost pure state.

# of its SALT

OUT IN California salt is being recovered from sea water in commercial quantities. The pictures below show details of the process.



Above — Harvesting the crude salt at the plant of the Leslie Salt Company on San Francisco Bay—the only factory in the country where "Old Sol" is employed to manufacture salt. After the sun has evaporated the sea water, the salt which remains is taken to the factory for refining by the vacuum process—the same as that used in refining sugar. From each cubic foot of sea water approximately two and a half pounds of salt are recovered. At the right are shown two of the large vacuum pans used in purifying the product.



View of the storage room where the refined salt is piled in sacks awaiting shipment. From here the salt is shipped all over the country.

TRICKS of the Filling

by MANLY S. MUMFORD

WHEN a motorist asks for five gallons of gasoline at an oil station, he may get it. And he may not. He may get four and a half gallons of gasoline and a half gallon of kerosene, furnace oil or some other adulterated form of gasoline.

There are many ways in which oil stations can, if they are so minded, bilk the public, and many of them do it. Generally speaking, the big oil companies operating thousands of stations are more careful in this respect, and have official orders to their employees commanding them to give the public a square deal. But there are thou-

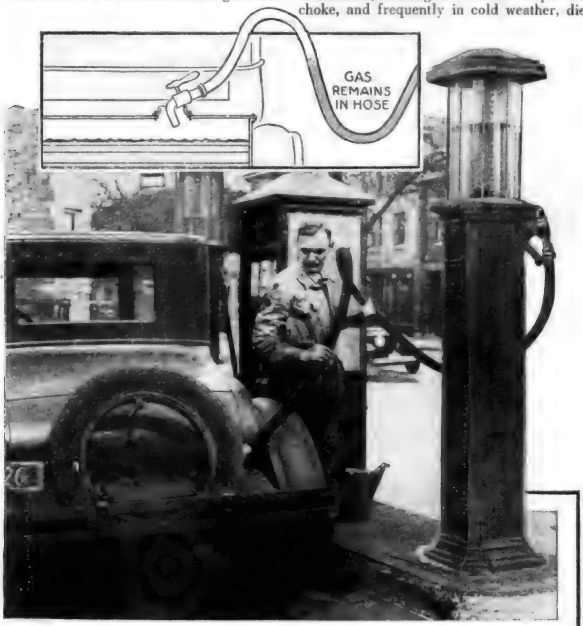
This photograph, specially posed to illustrate how unwary motorists may be fleeced, shows one of the favorite tricks of the oil station bilker. Motorists frequently receive gasoline diluted with 20% of fuel oil and never suspect the substitution until too late to protest.

Station Gyp Exposed

sands of wildcat stations run by individuals who are not so scrupulous.

There are two general methods of cheating the public at oil stations. One is to give the buyer inferior or adulterated goods and the other is to give him only a part of what he pays for.

First of all is the adulteration of gasoline. There are many grades of gasoline, some better than others, but the reputable oil stations sell only three or four grades, each of which is almost pure gasoline, the grades varying only in their volatility or ability to turn into inflammable vapor. The lower grades will choke up the carburetor on an automobile, causing the motor to spit and choke, and frequently in cold weather, die.



Note the kink in the hose leading from this oil pump. Over a quart of gasoline remains in the hose unless the attendant drains it carefully. The picture was specially posed to show a favorite method of cheating motorists.

Many of the cheating oil stations handle low grade gasoline, letting the public think it is high grade gas.

Some of them handle the high grade fuels, nationally advertised brands, but mix them with other petroleum products which are cheaper and cannot be detected.

Kerosene in the Gas

For instance if the station owner has to pay fifteen cents a gallon for gas and only 12 for kerosene, he may slip fifteen gallons of kerosene in a hundred gallon tank of gasoline.

Another favorite bet of the bilker is to use furnace oil. This costs him perhaps only 7 or 8 cents a gallon and he may be able to slip into your tank four-fifths gasoline and one-fifth furnace oil. The buyer cannot tell this either by taste or smell.

On lubricating oil the passing motorist may be cheated. It is a simple thing to have an oil tank with a label pasted on it. The label will probably indicate that the oil within is a high grade oil, bearing a trade mark or nationally known insignia.

One method of avoiding the short-measure filling station is to carry gasoline in tins as shown above, ready for pouring into the tank when needed. This is a popular European custom which originated in the fact that gas stations are few and far between over there.

The filling station owner pays perhaps 50 cents a gallon for a high grade oil. He sells it for a dollar a gallon, which is a fair profit. But low grade oil can be had for as low as 20 cents a gallon, leaving a much larger profit. Here again there is not much chance of detection by the buyer. He may find that his oil does not "wear" as well as he thinks it ought, but he won't find it out until too late.

The most favored method of cheating an automobile owner on buying gasoline, is known in the trade as "shorting the hose." Normally the attendant pumps the gas directly from a tank in the ground into the gas tank in the automobile. He uses a hose perhaps five feet in length. When five gallons have been delivered from the pump into the hose, five gallons have not yet entered the tank. A quart, normally, remains in the hose, and unless the attendant drains the hose into the auto tank, the motorist is short a quart of gasoline, getting four gallons and three quarts, instead of five gallons.

Another method of cheating which is more costly is the method of cheating the buyer of a whole gallon on his purchase. Most pumps are equipped with a bell which rings or an arrow which points to the number of gallons run through the pump. It is easy for a mechanic to fix the bell so that it will ring when three quarts have passed instead of a gallon or to manipulate the arrow so that it will point to five when as a matter of fact only four gallons have been delivered.

Then there is the method known as "going easy on the handle." If the attendant turns the crank at a certain speed the gas flows into the hose at a certain rate. If the handle is turned fast at first and extremely easy at the end the full amount of gas will not enter the hose. Sometimes the attendant will turn the handle slowly at the end of the stroke and will draw almost no gas at all, though the crank turns and the indicator or arrow with it.

Even draining the hose is not an absolute protection against cheating, because some lengths of hose have a little valve at the end which goes into the tank. The attendant can shut this valve and drain the hose to his heart's content, but no more gas will flow into the motorist's tank.

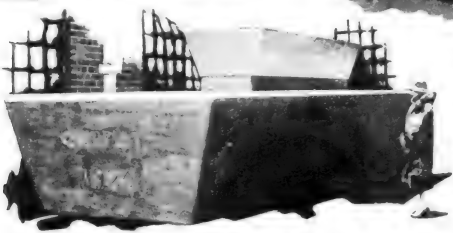
It's All GOLD that— Glitters Here

HALF of the yearly gold production of the world passes through the great refinery at Germinston, South Africa, where the photographs shown on this page were taken.

How would you like to have a truckload of these gold bricks in your garage? Each load is worth about $25,000.

Weighing the gold ingots. One brick is equivalent to the average man's yearly income.

At right—Pouring melted gold into moulds. The workmen are careful not to spill any of the golden liquid—it is worth about five dollars a drop!



At left — This concrete model gold brick shows the volume of production of the Germinston refinery for a recent fiscal year. Compare its size with the woman standing beside it. If this model were real gold it would be worth $200,000,000!

ELECTRICITY *Aids Today's*

With a torch which will burn under water already perfected by the U. S. Navy, the salvaging of sunken ship cargoes is becoming a profitable business in which incidents like that pictured above will be by no means unusual. Already electrical devices have been invented which locate buried gold and silver, and even discover oil pools and coal mines!

Treasure HUNTERS

By WARREN GIBBS

SUNKEN ships give up millions of dollars worth of gold every year to modern salvage hunters, who are equipped with the latest devices of science. Oil, gold, and silver are now sought for by mechanical treasure-finders operated by electricity and radio.

TREASURE hunting is usually classed as a will-o'-the-wisp occupation—all right for beachcombers or credulous individuals who have plenty of time for digging up the spot marked "X" on the oil-skin map turned over by the dying sailor of fiction, but not especially attractive to a hard-headed man who goes into business for the dollars and cents return. Most people who profess to know will tell you that treasure hunts are plain fiction anyhow. Maybe they are right. Maybe.

But how about the millions of dollars worth of gold bars that were salvaged from the sunken *Lusitania* by divers? How about the merchandise that is being recovered every day from ships that have gone down in shallow water? Strictly speaking, maybe these would not classify as treasure *hunts*, there being no question as to where the fortunes lie. Nevertheless, the divers who grope around in the dark sea depths, carrying only a mental picture of the architecture of the sunken ship, will heartily disagree with the landsman who assumes that all there is to recovering treasure under such conditions is to go down and get it.

The United States Navy has developed a special torch which will burn under water, generating an intense flame which can burn through steel in a few seconds. This device makes short work of cutting through the steel doors of a ship's vaults. But even when the gold bars have been found, as in the case of the *Lusitania*, they must be lifted individually to the surface. To drop a heavy bar is to lose it hopelessly in the muck and slime that covers the ocean floor. Hulks of sunken ships soon go to pieces under the battering of the water, stirred up by surface storms. When divers returned to the *Lusitania* in the spring, having left it untouched during the winter because storms made it impossible to carry on the work, they found that the ship had been broken up and twisted and torn so that no semblance of the original structure remained. Sometimes they sank in seas of mud which covered them entirely; eyes were useless, for there was no light; to force their way through the resisting mud was like walking into a sea of viscous syrup. Yet every now and then groping fingers closed on a slab of cold metal—and each time they did so another $50,000 worth of treasure was snatched from Davy Jones.

Perhaps this type of treasure hunting seems a trifle unromantic. Pieces of eight. Spanish galleons, golden jewel caskets, loot of Blackbeard and Morgan—that's more like it! Well, even in this day of cold efficiency the Government of Panama has issued a treasure hunting concession to Lieut. George Williams, who recovers buried treasure with an electrical machine which has already netted him thousands of dollars in actual cash. In order to secure his concession, Lieut. Williams put his machine through its paces in the presence of government officials, recovering pots of gold and silver which had been purposely buried to test the device.

Briefly, Lieut. Williams describes his machine as being based on the theory that all metals emit a distinctive wave, similar to but much higher than radio impulses, running to billions of cycles per second. A generator, transmitter, receiver, amplifier, and two aerials comprise the essential elements of the device. The aerials consist of thousands of feet of wire wound on a hoop. Power is sent through the transmitter to the first aerial, causing lines of force to circle from one aerial to another, cutting through the earth. These impulses are

picked up through head phones from the receiving aerial, and by the different sounds the searcher is able to determine whether or not there is a metallic deposit underground.

In the case of gold, which is a poor conductor, the lines of force pass around it and a very high pitched note is registered in the head phones. Lead gives off a dull sound. A deposit of gold was located on the estate of General N. de Obarrio at Juan Franco, Panama, at a depth of eight feet. Silver deposits were discovered on the same land.

Many of Lieut. Williams' investigations have been conducted in Old Panama, the site of the famous exploit of Sir Henry Morgan in sacking the city. Old documents placed at his disposal indicate that there is a staggering amount of gold and silver pieces buried in the vicinity, hidden by the inhabitants fleeing from the notorious pirate. Three treasures are claimed to be buried in Panama, the most romantic of them all being the life-size statue of the Virgin Mary, cast in pure gold by the Indians and presented to the seventeenth century governor.

A tunnel in Old Panama, leading from an ancient church, was uncovered by Lieut. Williams through his treasure finder. The tunnel had been cleverly filled up centuries before, but on digging at the spot indicated by the machine the old stone walls were uncovered. Pottery, ornaments of gold and silver, representations of ancient gods, and smaller articles such as rings and other pieces of jewelry were recovered from the cavern. One necklace recovered by Lieut.

Penetrating into a cavern unopened for centuries, the treasure hunter finds his greatest thrill. Above Lieut. Williams and his men are shown excavating a long abandoned tunnel, in which they discovered a number of ancient Indian relics.

Oil Pools Located Under Salt Domes by Use of Seismograph

Williams was a highly intricate piece of filigree work. A collar made of golden half-oranges also was found.

A special detail of police guards the scenes of Lieut. Williams' excavations until all the treasure has been recovered. Yet despite these measures of protection, the original treasure finding machine was stolen and Lieut. Williams is now using a duplicate. Having proved the possibility of recovering treasure in relatively small quantities, Lieut. Williams intends to seek out the large buried fortunes of legend.

"Doodle Bug" Diviners

Not all scientific treasure hunters are as fortunate as Lieut. Williams, however. Mankind has been building divining rods and home made gold finders for centuries, but most wielders of the "sticks," as these devices are termed, live and die without finding the big strike that is always just around the corner. Electricity, of course, is a modern development, and the application of electricity to the location of underground ore bodies is a new idea—but there is nothing scientifically unsound about it. The superstitious eagerness with which devotees of the "doodle bug" diviner expound the virtues of the apparatus is a testimony to the eternal hopefulness of human nature, for if such devices ever located a valuable mineral deposit it was certainly not through any scientific merit of design.

Dr. W. Paston, a Leipsic engineer, has developed a "radio emanator" which he claims will locate oil, coal, water and minerals up to a depth of 20 miles under the earth. It is really an electric divining rod employing principles of radio in its design, but details of construction are jealously guarded.

What with the development of these electrical machines, the old sourdough prospector seems on the way to becoming a creature of the past. Not even a fundamental knowledge of geology will be required when a pointer on a machine tells whether or not there is gold in the vicinity. Why be able to distinguish between iron pyrites and gold bearing quartz when all you have to do is carry an electrical prospector around and read the dials?

Already science is employing electricity on a large scale in discovering petroleum pools. Such pools are often found beneath domes of salt which overlie the oil hundreds of feet beneath the surface. To find an oil pool, therefore, first find a salt dome. This is not so difficult of accomplishment as it may sound; in fact, the presence of a salt dome can be detected without so much as digging a shovelful of earth. Briefly, the principle of operation is this: An explosive charge is set off, the sound waves travel downward into the earth and back again to be recorded on a seismograph—the same delicate machine that records earthquakes. A simple reading of the seismograph will disclose, from the nature of the vibrations recorded, whether or not the sound waves have "bounced off" the side of a salt dome, for when they have, a distinctive line is recorded on the instrument.

So, if you are out to make your fortune—invent an infallible gold-scenting machine and set it to work for you!

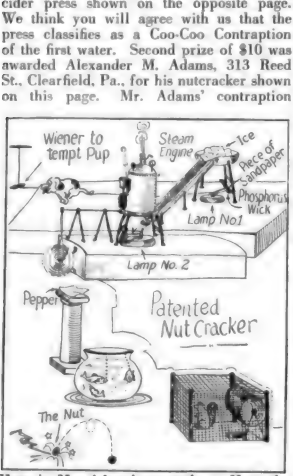
Dr. Paston is shown with his "radio emanator," which he claims will find oil, coal, and minerals 20 miles deep in the earth.

COO-COO CONTEST
Number 4

Names of the Winners of the Coo-Coo Contraptions Contest No. 1 and Details of Contest No. 4 are Printed Below.

LISTEN in now, all you folks who sent in entries in Coo-Coo Contraptions Contest No. 1! The winners have been picked and we're all set to announce the names of the seven lucky contestants. Before doing so, however, the harassed judges wish to thank all the entrants in the contest for the ingenious contrivances which they submitted. It was a Herculean task to select the seven winners from the avalanche of submissions which descended on the editorial office.

First prize of $25 went to H. Palmer, 11548 95th Street, Edmonton, Alberta, one of our Canadian readers, for his ingenious cider press shown on the opposite page. We think you will agree with us that the press classifies as a Coo-Coo Contraption of the first water. Second prize of $10 was awarded Alexander M. Adams, 313 Reed St., Clearfield, Pa., for his nutcracker shown on this page. Mr. Adams' contraption



Here is Mr. Adams' nutcracker. Note the hapless nut dashing out his brains when he sees his deadly enemy the squirrel, who has been awakened by the sneezing goldfish!

winds up to a snappy finish, the idea being, as shown, that the goldfish sneeze and awaken the squirrel in his cage. The nut to be cracked sees the squirrel and in a frenzy of fear at the proximity of its deadly enemy the hapless nut dashes out its brains on the floor—thereby accomplishing the purpose of the contraption.

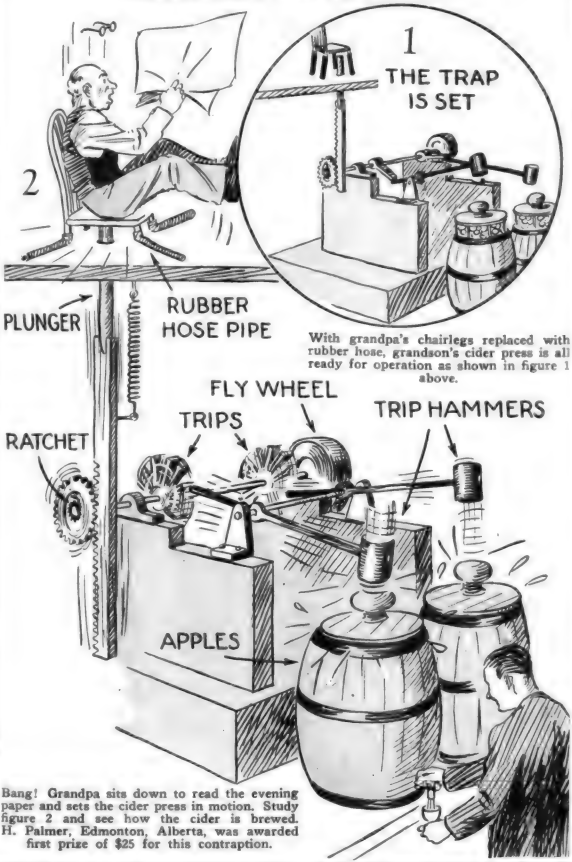
The five third prizes of $3 each were awarded as follows: Donald C. G. MacKay, Queens University, Kingston, Ont.; R. A. Reedy, U. S. S. *Concord*, Charleston, S. C.; Clarence E. Hill, Groton, Conn.; Paul Ranck, 1125 E. 16th St., Santa Monica, Cal., and O. B. LaFlair, Box 3287, Honolulu, T. H.

Now that Contest No. 1 has been disposed of, try your luck in the current contest, No. 4, announced herewith. Prizes will total $50 and will be divided as follows: First prize, $25; second prize, $10; five third prizes, each $3. Contest No. 4 will close March 1, 1929. Manuscripts received after this date will be entered in Contest No. 5. The Coo-Coo Contraptions Contests will run every month until further notice.

Manuscripts will not be returned. In case of a tie, duplicate prizes will be awarded the tying contestants. Address all manuscripts to Coo-Coo Contraptions Editor, Modern Mechanics Magazine, Contest No. 4, Robbinsdale, Minn. Decision of the judges must in all cases be accepted as final. There is still time to enter your Contraption in Contest No. 3 if you wish; this contest closes February 1. Prize winners will be announced as soon as possible after the closing date of the contest.

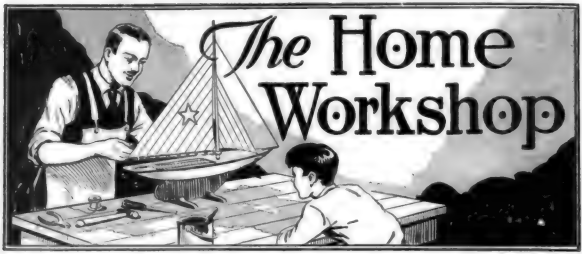
It is not necessary to make a finished sketch of your contraption, although it will be helpful to our artists if you wish to submit one. Study the prize winner on the opposite page and design some device just as coo-coo and just as funny. Remember that the prize winners will be judged on a basis of humor and originality. Anybody except employees of the magazine can compete in the contest; it is not necessary to be a subscriber to Modern Mechanics.

GRANDPA'S CIDER PRESS



With grandpa's chairlegs replaced with rubber hose, grandson's cider press is all ready for operation as shown in figure 1 above.

Bang! Grandpa sits down to read the evening paper and sets the cider press in motion. Study figure 2 and see how the cider is brewed. H. Palmer, Edmonton, Alberta, was awarded first prize of $25 for this contraption.



Conducted by A. NEELY HALL
Author of "The Handy Boy," "Outdoor Boy Craftsmen," etc.

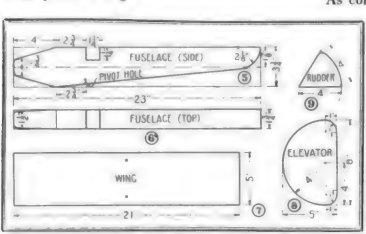
TO BOYS all over the country the name of A. Neely Hall has long been familiar, for his helpful articles on how to build things have been appearing in national periodicals for many years. In this department Mr. Hall's latest designs for the boys' workbench appear regularly each month.

You Can Make Yourself an Airplane Weathervane

BOY! This is some weathervane. It looks just like a real airplane, with enclosed cabin, wing, elevator, rudder, landing chassis, cylinders and propeller, done in aluminum. Indeed, when the model is aloft on a tall post, silhouetted against the sky, now turning this way, now that, with propeller whirling merrily, one might mistake it at first glance for a large plane in flight.

An advantage that the weathervane airplane has over other airplane models is this: there is nothing fragile about it. It will weather any storm short of a tornado. Of course it does not have the appeal of a successful flying model, but I suggest that you build it and set it up as a symbol of your interest in aviation. Let it designate your backyard as a model airplane airport.

As compared with building a flying model, the work on the airplane weathervane is very elementary. Figure 1 shows a side elevation of the model and its post support. Figures 5 to 12 are patterns for its parts. Other sketches show assembly details.



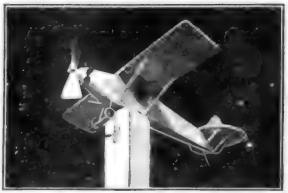
Here are patterns for the fuselage, wing, elevator and rudder of the airplane weathervane.

The fuselage is of a piece of 2-by-4. Lay it out by the diagrams of Figs. 5 and 6, with tapered nose, and the under side tapered from nose to tail. The notch in the top forms the cabin windows. After sawing out the piece, smooth up the curved tail and the rounded nose with a

wood rasp and sandpaper. Trim the windows with narrow strips of wood, as shown in Fig 1.

Cut the wing, elevator and rudder out of straight box boards ⅜-inch thick. Figures 7 to 9 show their dimensions. Screw the wing to the fuselage close to the nose taper. Mount the rudder along the center of the elevator, as shown in Fig. 2, then screw and nail the elevator to the fuselage so the rudder lines up with the curved tail, or what should be the lower portion of the rudder (Fig. 1). The plane and elevator braces are strips of galvanized iron. Drill the ends of the strips, and bend them, as shown in Fig. 20. Then screw the lower ends to the fuselage, and rivet the upper ends to the wing and elevator. Drill holes for the brace rivets.

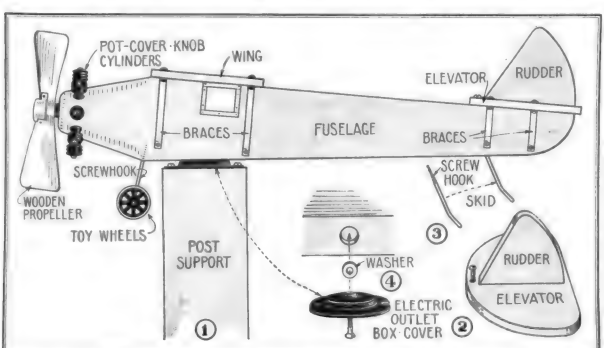
The propeller is carved after the manner of flying model propellers, but the blades are thicker. Start with a block of the dimensions given in Fig. 10. Draw diagonal lines through the corners, on two opposite faces, drill a 7/16-inch hole through the center, and ¼-inch either side of the center draw a line parallel to the edge (Fig. 10). Saw the block along the diagonal lines



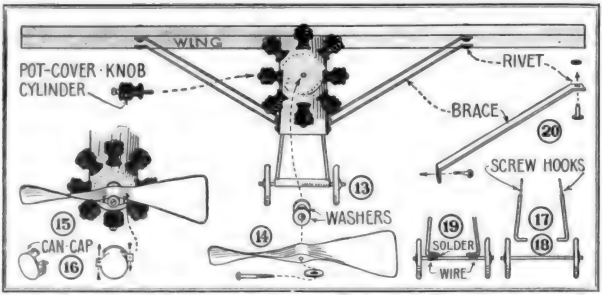
Here is the completed weathervane, mounted on a pedestal where it swings with the breeze.

from the ends to the parallel lines, then along the parallel lines. The block, now of the form of Fig. 11, is ready for carving. Draw diagonal lines ⅛-inch apart across the block ends, as indicated by dotted lines in Fig. 11, and cut away the block until these diagonal lines are reached, and the shape is that shown in Fig. 12. In carving, reduce the hub's thickness to ⅝-inch, and its width to ⅜-inch. Finish the blades and hub with sandpaper, and round the corners of the blade tips as shown in Fig. 14.

Use a ⅛-inch round-head screw 1½



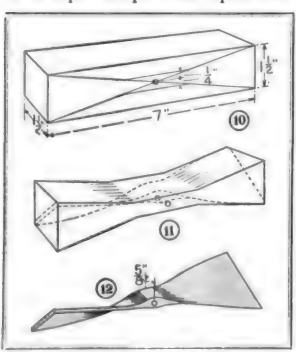
Assembly of the completed weathervane, with details of fuselage, wing and rudder mounting, are clearly shown in the above diagrams. Follow the style of mounting shown to make sure that the airplane will swivel properly.



Details of assembly of the airplane weathervane. The method of mounting the propeller and landing gear is shown, together with the details of imitating the rotary engine cylinders.

inches long, and three iron washers, for mounting the propeller. Drill a hole in the nose of the fuselage, and drive the screw home, with one washer between the screw head and hub, and two washers between the hub and nose. Drive the screw straight so the propeller will run true.

Trim the hub with the cap from a talcum-powder can (Fig. 16). This will look like the spinner cap on "The Spirit of St. Louis." Snip the edge of the tin cap, as shown, and bend out two ears, upon opposite sides. Then fit the cap over the hub, and fasten the ears to the propeller blades with small brads or rivets.



This is the way in which the propeller is carved from a rectangular block of wood.

Cylinders are formed of pot-cover knobs (Fig. 13). Eight of these space out nicely around the nose. It will be necessary to trim them off slightly, to make them fit squarely upon the tapered nose. Replace the knob bolts with 1-inch screws.

The landing chassis is shown in the photograph and Figs. 1 and 13. Use screw hooks 3½ inches long for the wheel struts (Fig. 17), and a pair of toy wagon wheels and their axle (Fig. 18). Probably you can pick up a bargain in a broken wagon in a toy store, if you do not find wheels at home. Screw the screw hooks into the fuselage at the points indicated in Figs. 1 and 13, and slanted as shown. Then wire the wheel axle to the hook ends (Fig. 19), and make a neat housing of solder, as shown in Fig. 13.

The tail skid is another screw hook, with the end bent nearly straight (Fig. 3). Screw it into the fuselage at the point shown.

The model should now be ready for finishing. Sandpaper surfaces that need smoothing. Then give the entire model a coat of shellac as a filler, and when this has dried, apply a coat of radiator aluminum paint.

In looking about for a suitable mounting, I hit upon the scheme of using the cover to an electric outlet box (Fig. 4). You can buy one at a hardware store for a dime. The cover has a center hole of the right size for a screw to pivot it to the fuselage, and two rim holes through which to drive screws into the post support.

Pivot the mounting plate as far forward as possible (Fig. 5). But make certain that the landing chassis will clear the post support. You will probably find a narrow rim around the center hole in the plate (Fig. 4). Bore a hole in the edge of the fuselage, large enough for this rim to set into, then slip an iron washer into the hole for a bearing. Use a screw 1¼ inches long for the pivot, one with a head large enough so its bevel will seat itself on the edge of the hole. Make a nice adjustment here, and the plate will spin upon the washer with little or no friction.

Use round-head screws or lag screws for fastening the model to its post support, turning these down with a pair of pliers.

The photograph does not show points of the compass upon the airplane weathervane support, but you can readily devise a set to make your model more complete.

BARREL STAVE SKIS

IF ONE of your bunch can scare up a barrel, that barrel will furnish staves for a dozen skis. You will see by the

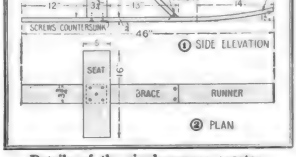
diagram that a piece of board is fastened several inches forward of the center of the stave, and that a house slipper is nailed to this board. If you lack a slipper, cut down an old shoe or overshoe. For a more efficient ski, smooth the sole with sandpaper, then rub in linseed oil and polish with floor wax.

If the skis do not rack straight, cut a groove in the bottom of the skis with a routing chisel. Do not rout out too much. A groove about ¼-inch wide and ¼-inch deep will do nicely to pack the snow under the ski and hold the user on his course.

SINGLE-RUNNER COASTER

THERE is a knack to keeping one's balance on a single-runner coaster which you may acquire quickly, or may not. The coaster requires a 1-by-4 board 6 feet long for the runner and brace.

The runner must have a slight curve to its bow, as indicated in Fig. 1. To warp the wood, steam it or soak it in hot water, then place the bow end in a vise, and block up the other end until a curve a trifle greater than that shown is obtained.



Details of the single-runner coaster.

This Easily Made Air Spinner of Tin is Powered by Cord and String

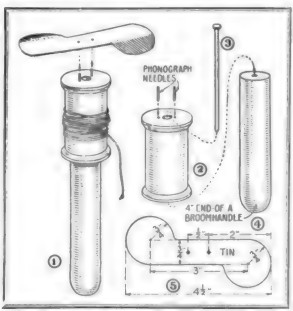
This air spinner, powered by a spool and string, rises to surprising heights when released.

YOU can make this home-made air spinner rise almost perpendicularly, or spiral to the right or to the left, according to how you adjust its tips. It rises until the spinning momentum has been expended, often to a surprising height, then slips back to earth.

Figure 1 shows the spinner blade and its spinning device. For material, get a large thread spool and a pair of phonograph needles (Fig. 2), a common nail 1 inch longer than the spool (Fig. 3), a broom-handle end 4 inches long (Fig. 4), and a piece of tin cut from the side of a tin can.

Drive the phonograph needles part way into the spool end, with a spacing from center to center of exactly ½ inch. Drill a hole in the end of the broom handle a trifle smaller than the nail, slip the nail through the spool, and drive it into the drilled hole. The top edge of the spool must be trimmed so the nail head can be countersunk.

Figure 5 shows a pattern for the spinner. Lacking a compass, mark out the tip circles by drawing around the end of a spool. It is important to space the needle holes exactly ½ inch from center to center, so the needle ends will fit in them, also to get the holes an equal distance from the center of the spinner. Drill the holes a trifle larger than the needles. When you have cut the spinner, bend down the tips as indicated in Fig. 1, then bend slightly at the center, so the straight edges will slant up from the center to the tips.



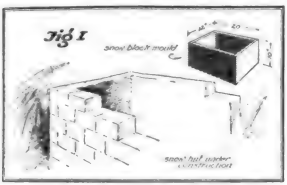
Details of the air spinner assembly.

USE THE RADIATOR AS A STEAM BOILER

THE usual radiator in which a couple of pounds of steam is always present when the radiator is functioning will make an adequate source of pressure for the simple toy engines which Modern Mechanics is publishing from time to time. A small rubber hose will be found to be of no use to convey the steam, so a length of copper tube should be soldered on to the steam cock, and from the end of this length of tube there should be run a small length of dental hose. This will connect with the engine.

Winter Shelters

MUCH of the discomfort that comes from winter trapping, hunting and fishing, can be eliminated by the use of some suitable shelter. If your trap line extends up the river for several miles on one side and then down on the other side, you should have a shelter at the upper end in which



you can rest, cook a snack to eat, or pass the night if necessary.

It may be that you need such a shack for only a few weeks of mid winter. Then the shelter shown in Figure 1 will do nicely. It is made entirely of snow blocks, with a roof covering of poles and snow.

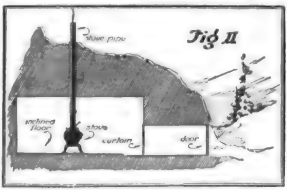
For the snow block mould get a board one inch thick, ten inches wide and sixty-two inches long. Cut this into four pieces as indicated. If the cuts are made square, the box will have right angles when nailed together. This is laid upon a smooth surface and packed with snow. A board to fit loosely inside should also be provided. When the block has been made, place the fifth board upon it, then pull up on the mould. This will slip the block clear. Let it set and build another.

When you have made enough of the blocks, set them in rows to form the hut, leaving one opening for the door and one other, somewhat smaller, for a window. A good size will be six feet wide and eight feet long. With the walls seven feet high, lay poles across the top, inter-twining smaller branches to form a rather close covering, then pile high with snow and pack this down.

The cave shelter shown in Figure II is not new, but less often used than its convenience would seem to warrant. A well-built cave, dug in compact clay and equipped with an outside door, a stove pipe flue and having natural drainage, will be inhabitable for several seasons without further attention.

The bank to be used should have a well-protected southern exposure. It should rise abruptly for eight or ten feet, then shelve back slowly so there will not be too much earth between cave ceiling and the ground surface overhead. The hole for the stove flue can be made with an ordinary post hole digger.

The cave should consist of two compartments. The first to be excavated is the tun-



nel or outer room. It need not be more than two feet wide and four feet high. It runs back into the bank for six or eight feet, then the floor rises a few inches and the cave proper is dug.

A good size will be with walls six feet high, a length of eight feet and breadth of five feet. Case up the outer opening and hinge a good plank door in place, equipping it with a hasp and padlock. At the inner end of the tunnel, hang a thick rug or curtain to further check any cold drafts which may tend to enter.

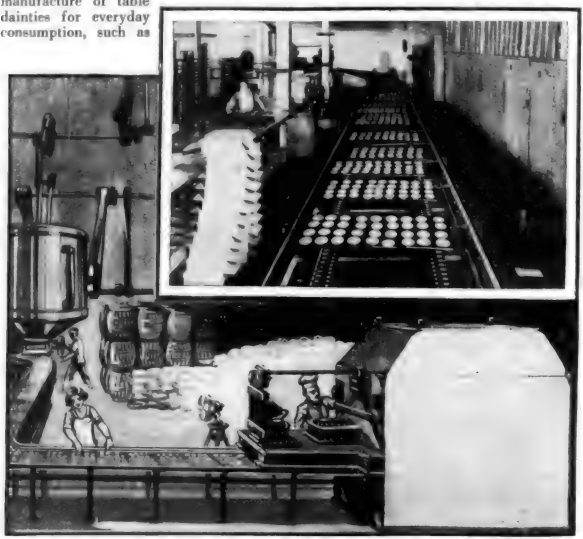
A HUNDRED MILES

USING complicated machines, modern bakeries turn out millions of cookies every day to satisfy the American sweet tooth.

MUCH has been said of quantity production, and in the public mind the term usually is associated with motor car assembling. But the process of continuous manufacture was in use in other industries long before the automobile achieved its remarkable popularity.

Among the interesting and romantic if not so widely advertised industries utilizing the continuous process of production is the manufacture of table dainties for everyday consumption, such as cookies and other pastries. These factories also have their miles of conveyor belts which pick up raw materials at one end of the plant, receive added ingredients as they pass certain stages, and finally emerge a completed product.

Cookies are one of the leading products of the pastry and confectionery industry. They may be said to be an American institution, in that the United States leads all



The endless belt system of quantity production is used in carrying pastries from the dough-cutting machine, through the baking ovens and thence under cooling fans to the shipping rooms where they are packed for delivery to the consumer. Photo inset shows a line of cookies going to the ovens.

# of COOKIES Every Day

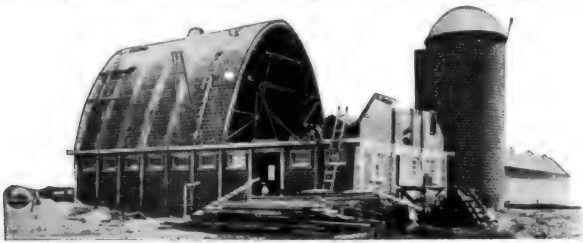
other nations in their manufacture and sale.

The bulk of ingredients that go into a modern cookie plant and the number of individual articles that come out in a finished stage offer a computation in mathematics. In many cities there are factories that produce hundreds of miles of cookies every week. A production of 100,000 cookies a day requires about 125 sacks of flour, 7,000 pounds of sugar, 500 gallons of pure, fresh milk; 500 pounds of butter, 9,000 dozen eggs, 3,000 pounds of shortening and 2,400 pounds of fruits.

The huge batches of ingredients go into giant electrically driven mixing bowls armed with paddle agitators which work up the dough. When the mixture is ready, it is cut into shape and delivered to an endless belt which carries the dough through the ovens into the shipping room.

Fancy cookies with elaborate frostings must still have the finishing touches applied by skilled dippers, as shown in the upper right photograph. Although cookies are usually packed by machine, in the case of assorted flavors they are hand sorted by girl packers, as shown in oval.

New Fire-Proof Barn Designed by Iowa Engineers



FIRES will no longer be the greatest fear of the farmer. A new wrinkle in farm buildings has been developed at Iowa State College, at Ames, by engineers under the direction of Mr. J. B. Davidson, who is the head of the Agricultural Engineering Department, whose work it is to design and foster new development in farm machinery and farm buildings. This building is fire-proof because there is so little combustible material used in the construction that it can not burn. The barn is constructed entirely of masonry, hollow tile being used as the base material. The most notable feature of this building is the arch that has been used to complete the hay loft. The catenary arch, long familiar to engineers, is employed in the new building. This arch has been used for years to accomplish the same object that it must serve in the barn, namely, to bridge over a large space without the use of pillars. This type of loft gives the hay space. The masonry used in the arch is reinforced by the use of concrete ribs every six and a half feet along the roof.

This complicated machine is a new type eye-testing device.

NEW EYE TESTER

THIS remarkable instrument, which is in reality a battery of lenses no bigger than a cigar box, enables the optician to secure over one million combinations of lenses almost instantaneously. The London Refraction Hospital which has recently been rebuilt at a cost of $50,000, contains this machine among many others of the same type. Testing of the human eye is one of the most difficult tasks that the eye specialist encounters. Every person has different eye strengths so this machine was developed to reveal the fact that a patient's eye deviates by as little as a quarter of a degree from its normal outlook. The patient is fitted to the machine and then the optician adjusts the various lenses until the proper lens fits each eye.

This device is practically "fool proof" and the optician is enabled to measure the eye with extreme accuracy.

Uncle Sam Delivers Timber Sent First Class Mail

UNCLE SAM was recently called upon to perform a rather odd duty as postman. The erstwhile Secretary of Commerce, Mr. Herbert Hoover, needed a specific piece of lumber as a sample for the meeting of the National Committee on Wood Utilization. The meeting was scheduled in Washington. The lumber was in St. Paul, Minnesota. The Secretary ordered the length from the Weyerhaeuser Lumber Co., of St. Paul and they, in order to deliver in the fastest possible time, sent the article by first class mail. The ends were covered to keep them from splitting, a wrapper was placed on the middle, and Ralph Weyerhaeuser placed the timber in Uncle Sam's hands. The size of this piece of lumber is the most unusual aspect of the feat.

NEW PLEASURE CRAFT

A LOS ANGELES man has invented a new type of pleasure boat. The boat has a round, metal air-filled pontoon to keep it afloat. There are twin paddles to control the boat. One of them furnishes the motive power while the other steers the odd craft. The interior of the boat is shown here with three young ladies engaged in giving it a trial spin. The boat is built to carry four persons comfortably but a maximum load of eight people can be safely handled.

SKY'S BRIGHTNESS MEASURED

UNITED STATES Public Health Service officials are carrying on experiments in Washington so that architects may better space the windows which light our homes, offices and factories. Dr. L. R. Thompson and Dr. James E. Ives are in charge of the project. It is the plan of these two men to measure the brightness of the sky under varying weather conditions. From the results obtained by their experiments they will derive scientific facts which will set illumination problems into well established channels.

CANOE CROSSES SEA

TWO young Germans, H. Conrady and Walter Lienweher, recently crossed the North Sea in the rubber canoe shown below. The two young men aided with small sails are planning to take a two-year cruise via Holland, Belgium and France, and after a visit to London they will travel to Scotland, Ireland and Spain. The canoe sets so low in the water that the two occupants have to be protected with tight fitting rubber belts. With this water-tight equipment the canoe will stand a fairly rough sea.

Two ingenious young Germans are making an extensive cruise in their tiny rubber canoe.

The Surveyor GROWS

by ORVILLE H. KNEEN

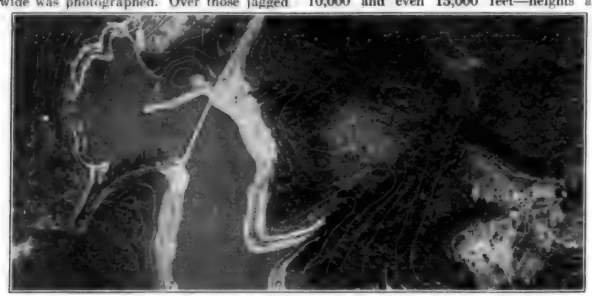
SOME years before the War I was a member of a surveying party assigned to finding and staking a practicable pass through the mighty Cascade Range of Washington. We fought the wilderness for seven months, forcing our way through matted sallal and devil's-club and tangled vine maple, detouring around enormous fir, cedar and hemlock.

Such a pass would be located differently today. In a few hours, from an airplane sweeping over those 250-foot evergreens and high snow-capped peaks, photographs would be made of every possible location. In the office "mosaics" or even true-scale maps would be constructed—and errors such as the best land surveyors make would be impossible for these aerial map-makers.

During a recent northern survey, daring Navy fliers in an amphibian plane photographed a vast region in southern Alaska. There were days when in an hour or so of flying, a strip 100 miles long by seven wide was photographed. Over those jagged ranges and deep chasms a forced landing anywhere away from their bases would almost certainly have meant a fatal crash. But so skillfully have engineers developed planes, cameras and details of this new "bird's eye mapping," that no accidents or delays occurred. In three months they photographed glaciers, canyons and vast expanses of terrain that would have taken ground surveyors more than ten years to reduce to usable maps. Averaging a thousand square miles a day, and flying over 50,000 miles in 385 flying hours, their detailed mosaics revealed scores of new lakes, rivers and power sites, as well as millions of acres of timber never before seen.

A War Development

"Surveying the landscape o'er," with the aid of a flying lens, was developing swiftly as the War closed. The new art was first devised for the detection of troops, trenches, guns, supplies, ships and submarines. For such purposes, and many others today, mosaics of overlapping pictures pieced together are quite accurate. A telephoto lens will record sharp images from heights of 10,000 and even 15,000 feet—heights at



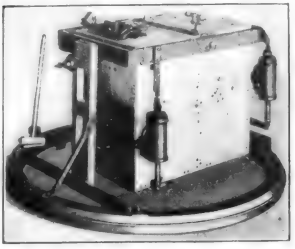
Aerial photography is the latest aid to the surveyor. Photographs are taken from planes flying miles above the ground, and contour lines showing various elevations of the land are later drawn onto the pictures by an ingenious "stereometer" which produces a finished map like the one shown above.

which the plane is often out of sight and hearing.

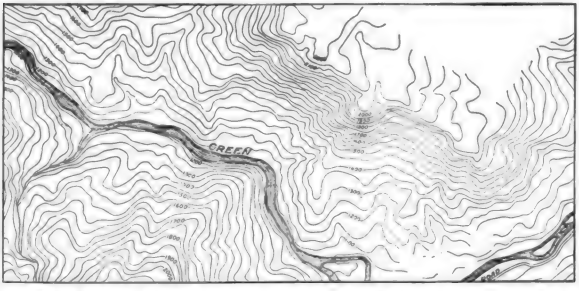
A representative of a map-making concern stopped to tell the chief selectman of a Connecticut town that the plane was at that moment flying above them, out of sight, 15,000 feet high, taking aerial photographs of the town. The selectman looked at him a minute, disbelief written all over his face. He glanced aloft once more. Then he said: "I've always believed you were an honest man, but when you tell me that a plane out of sight could take a photograph showing every tree and fence, you're nothing less than a liar." And that hardboiled Yankee never would admit that the photographs he later received, made into an air map were being taken on that day and at that moment!

This same immunity from observation has proved as useful in peace time as in war. George T. Bergen, an engineer who has made a detailed study of precise aerial surveys, tells of a high-power transmission line projected through fifty miles of valuable farms, across highways, railroads and towns. Premature publicity, such as would inevitably attend a ground survey, meant innumerable delays, law suits, bickerings and needless increase in the cost of right-of-way.

But a photographer flying entirely unsuspected at a height of two miles, snapped a strip of overlapping pictures. With a few known landmarks as reference points, an accurate network was plotted in the office from the developed pictures. The mosaic was pieced together over this controlling net, and the line laid down on the mosaic, so as to minimize costly crossings. With this help the right-of-way man obtained the required property easily and quickly, and the final locating party on the ground was also aided in its work.



The Brock mapping camera—a precise instrument for special survey work. Glass plates in magazines holding four dozen are used.



An example of contours along steep hillsides and river bluffs. The closer the contour lines, the steeper the hill. Contours of a perfectly vertical precipice would all run together on top of each other.

No One Wiser When Land is Surveyed from Air

Here the Brock mapping camera is shown installed in a plane. Its mounting pivots in such a way that gravity always keeps the camera pointing vertically regardless of the position of the airplane.

New York Poses

Not long ago Greater New York, 625 square miles in extent, was photographed with 2,000 separate exposures, requiring some 3,000 miles of flight. The final mosaic shows every street, building, pier and corner—also the traffic congestion. An aerial survey of an Eastern town had the unique result of reducing taxes—that is, reducing them to all except the owners of 1,896 "newly-discovered" buildings, previously omitted from the rolls.

It was for the more exacting uses, especially where elevations of the surface are required, that the Brock aerial contour-map was developed. Not only is it free from distortion and therefore scalable at any point, but the usual contour lines are plainly marked, from which the actual elevation of every structure, hill, mountain or valley can be read. Heights are figured and drawn with marvelous accuracy from the original photographs.

Brock & Weymouth, Inc., engineers, who developed and utilize the process, told me how they operate. Landing facilities are the first consideration. On a job too far away from the home base at Philadelphia, the nearest airport is selected; sometimes a farmer's field must serve. Running water and electric light are important—not so much for the fliers' comfort, as to facilitate night development of the negatives.

The aerial mappers use as guide-maps the best obtainable, usually U. S. Geological Survey sheets where they have been made. A reference mosaic is built up by piecing together the pictures made each day, the large overlap reducing the edge-distortion caused by perspective.

One of the features making for accuracy in the Brock process is the "ground control" line, usually about 3,000 feet long. This is actually surveyed on the ground between sharply-defined points such as acute road intersections or points of shore lines, which show up clearly from the air. Before the office work is done there must also be known the *difference* in elevation of four points in each control field, usually determined by ordinary leveling.

It is not surprising to learn that only four or five of every hundred trained airmen can become good photographic pilots. As one of these busy birdmen expressed it: "If you really want to know what it's like, try walking sideways on stilts along a crack in the

Stereometer Reveals Contours of Aerotopographic Maps

floor while viewing the crack, through the small lenses of a pair of binoculars."

In the Brock process, shipping the hundreds or even thousands of pictures to the home office in Philadelphia starts the real mapwork. Here highly trained men determine the sea-level elevation of every important feature. The first problem is to determine the tilt of each print. Gyroscope and pendulum devices have been tried to keep the camera level, but they fail to operate fast enough. Every variation in the plane's height changes the scale of the photograph.

So in the office the apparent elevation of a prominent object is compared with its known height above the ground, in two adjoining views which show the same object. This fixes the actual "tilt" of the camera when a particular view was taken. This tilt is only a few degrees at most, usually less than one. But it must be corrected. The glass plate is then set for the angle of tilt, and re-photographed. Thus is obtained the view which the photographer would have had if his pilot had been able to keep the camera absolutely horizontal.

The next operation is to determine the elevation of point after point on the photograph, by use of the ingenious "stereometer." This device is something like the old stereoscope with which our grandfathers gained a startling and vivid illusion of depth in twin photographs. Looking into the stereometer, the engineer sees the landscape with every detail of relief.

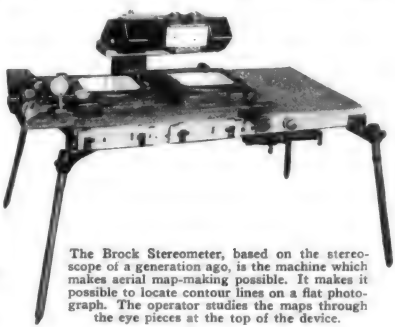
Adjustable cross-hairs on the stereometer enable the engineer to read the height of objects on the plate with astonishing facility. The height, or depth, becomes actually measurable. In other words, he mechanically measures the photographic "parallax," and locates the elevation contours with great accuracy.

The points of identical elevation around a closed valley, for instance, are connected to form the irregular contour lines of nature. Such lines correspond to the irregular shore-line of a pond or lake, in which you see a new shore-line for each change in water level. Such contours enable engineers to tell, for example, how much land a certain level of water in a reservoir would cover.

Higher points on the ground are nearer the aerial camera, therefore the picture fixes them on a larger scale. So by an ingenious method of plotting and re-projection, the final true-scale record is obtained. Thus a river flowing down a steep incline seems from above to be growing smaller; on the corrected map it shows to its exact size at every point. The final map is similar to that made by the draftsman from data supplied by a surveying party and topographer.

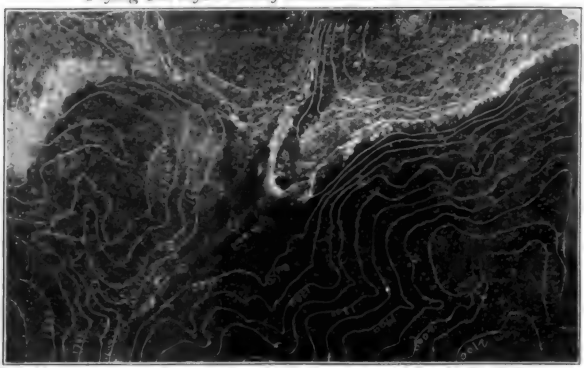
Photographing 6 Miles High

Good views have been made up to 18,000 feet high. One photograph at 17,000 feet made by the Brock company shows transmission wires crossing a river. In 1924 Captain A. W. Stevens of the U. S. Army, in an airplane piloted by Lieut. J. A. Macready, photographed the entire city of Dayton, Ohio, in a single picture covering 19



The Brock Stereometer, based on the stereoscope of a generation ago, is the machine which makes aerial map-making possible. It makes it possible to locate contour lines on a flat photograph. The operator studies the maps through the eye pieces at the top of the device.

Flying Surveyors Daily Risk Lives in Wilderness



The white contour lines shown on the above map were traced by the Brock Stereometer. Weeks of arduous labor would be required to survey this wild forest land using old methods, but only a few hours were needed to complete the aerial survey.

square miles—from an altitude of 31,500 feet, practically six miles!

To eyes accustomed to ground views, skimming over the earth's surface at great heights will play some queer tricks. Tall buildings appear to grow smaller from top to bottom. All elevated objects seem to lean away from the center of the picture. Pole lines often disappear; sometimes they show as a series of evenly-spaced white dots, not the tops of the poles, but the piles of excavated earth at their bases!

As the plane roars along at a hundred miles an hour, objects and fields below change their apparent position much the same as under the eye of the train traveler. Distant objects seem to move more slowly than those nearby. It is this peculiar effect, which on the pictures is called "parallax," which makes contour mapping possible. Two views of the same object, from different positions, make its accurate location on the final map merely a matter of careful office routine.

A rather unexpected result of this microscopic office work is that ordinary photographic film and printing paper were found useless. Both shrink so much and so unevenly as to render the desired accuracy impossible. Glass plates are therefore used in the special aerial camera, to which they are fed from a magazine. From among large numbers of lenses, collected from all over the world, the engineers selected only those so accurately ground that distortion could be safely discounted.

Detailed cost data have not been published but they are gradually being accumulated and indicate advantages for the aerial method, particularly in topographic surveys of large areas having bold relief and considerable growth of timber or brush. Under such circumstances the data available indicate that airplane topographic surveys may be made for a fraction of the expense required for comparable results by instrumental surveys on the ground.

It takes one by surprise to learn that even when the ground seems to be completely masked with heavy timber, as in the Green River gorge of North Carolina, there are almost always sufficient open spaces between the tree-tops so that in the stereometer the elevation of the ground itself can be accurately determined.

PATENTS ~ NUTTY or NOVEL?

BELIEVE it or not, the United States Government has issued letters patent on the extraordinary devices pictured on this page. The average owner of a patent is lucky if he breaks even on expenses. Out of some two million patents granted in this country, the number which never make a cent for their inventors reaches staggering proportions.

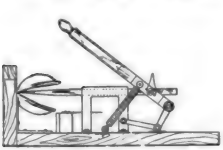
CANNON PLOW FOR EMBATTLED FARMERS

MURDEROUS mercenaries from the enemy's troops who sneak up on an unsuspecting farmer are likely to receive a rude slap in the face when the agriculturist nonchalantly applies a match to the fuse of his plow cannon, invented by a cornfield Cincinnatus.

AUTO BATTLESHIP WRECKS WIRE FENCES

SUPPOSE you are tearing along a dark road some night and run into a rope barrier stretched across the highway by some hijacker—what are you going to do about it? Well, if you have foresightedly equipped your car with the wire-cutting bumper shown in the picture at the right, you will have no trouble whatever. Wandering through barbed wire fences and meandering through tennis nets are the best things this machine does.

PRYING INTO THE PRIVATE LIFE OF AN OYSTER



AHA! Here's another of the perennially blossoming contraptions designed to invade the tightly sealed shell of reticent oysters! One of the difficulties oyster dredgers have in marketing their product is to quickly prepare the oyster, separating the mussel from the shell. It's easy once the bivalve is open, but try to open that shell! This combined Caesarian battering ram, ice hatchet, piston rod and Walchaert valve gear is designed to be leaned on by a 180-lb. oysterman who is guaranteed speedy access to the inner life of the oyster.

Conducted by **MAJOR H. H. ARNOLD**

THIS month Major Arnold begins a discussion on airplane engines which builders of light planes, such as the Heath Parasol described in this issue, will find extremely interesting. Major Arnold is a flying officer of the United States Army, and during the war he was Assistant Chief of the American Air Service.

Lindy's Radial Engine Most Efficient Air Motor

MANY airplane engineers and designers have made the statement that both the airplane and airship would have become reliable means of transportation much sooner than they did, had there been dependable, light-weight engines available for installation.

Prior to 1903 little was known of the gasoline engine as we understand it now. Accordingly practically every inventor endeavored to use steam or electricity for propelling power. The steam engine was entirely too heavy for the power delivered and the electric motor-battery combination was not practical for dependable or sustained use.

An inverted Liberty engine is the power plant for this amphibian, which was one of the planes that flew around South America. Note the crankshaft projecting from the top of the engine.

Early gas engines were not constructed with a view of cutting down weight. Then again, power was not an important consideration. Automotive engineers were trying to turn out an engine which would run when the car was on the road. As a matter of fact, however, very few of those first autos could be counted on to keep going for a distance of twenty-five miles. The first Wright plane weighed less than 800 pounds with engine, fuel, accessories and passenger.

Power plants suitable for aircraft may be divided into two classes—electric and heat engines. Heat engines are again divided into two classes—the external and internal combustion types. Of the first type the steam engine, steam turbine and the mercury vapor turbines are the best examples. None of these are practical for aircraft without further improvements. The engines of the second type are gas and oil engines and gas turbines. The gas turbine is at present in more or less of an experimental state. The oil and gas engines are practical power plants.

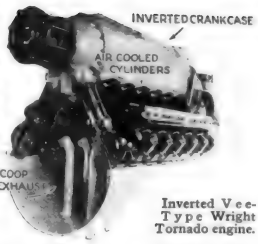
As the actual efficiency of engines of the different types is not generally known, the following is given so that a complete picture of the power plant problem may be obtained. The thermal efficiency of an engine is the ratio of power delivered to the potential power in the heat value of the fuel used. The ordinary, every-day thermal efficiency of the different types of power plants is:

Steam engine	22%
Steam turbine	25%
Gas engine (5.5 compression)	25%
Gas engine (7.5 compression)	31%
Diesel engine	32%
Mercury turbine	35%

In any heat engine the useful work is obtained from converting the heat developed into power. In a fairly efficient engine the heat developed is disposed of as follows:

Gross work—	30%
Useful work	25%
Friction	5%
Exhaust loss	50%
Radiation loss	20%
Total	100%

From the above it is seen that even the most efficient of engines is still comparatively inefficient when actual power developed is compared to the potential power in the fuel. Accordingly, in aircraft installations where every pound of weight is carefully considered, only the most efficient engines are used.



Inverted Vee-Type Wright Tornado engine.

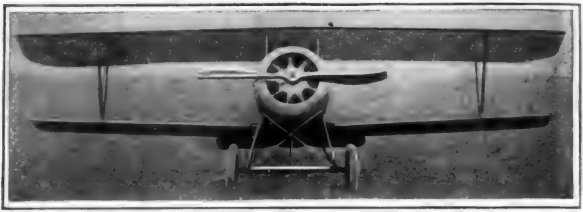
Gas engines to date are by far the most practical aircraft engines obtainable.

Gas engines may be classified under two heads,—air-cooled and water-cooled. The water-cooled type developed closely along the lines of automobile engines at first, but as the necessity for a distinctive aircraft type became apparent, the airplane engine, water-cooled, as we know it today, came into being. In so far as general principles of operation are concerned, the aero engine and auto engine are very similar.

However, in construction, materials used and power produced, the two types of engines are very different. Probably the best known of all airplane engines in the United States is the Liberty. This engine produces about 440 horse power when turning over at 1,750 revolutions per minute. It is very compact, lends itself to installation in an airplane and weighs about 875 pounds.

Today there are many engines, water-cooled, much more efficient than the Liberty.

One of the first "flivver" planes built was the Sperry Messenger, shown above. It had an 18-foot wing spread and was powered with a 60 H. P. Lawrence motor.



Here is the Nieuport, one of the most popular fighting planes used in the late war. It is powered by a Gnome rotary motor, the cylinders of which revolve with the propeller.

The Curtiss D-12 weighs but 690 pounds and delivers the same horse power as the Liberty. Other modern engines are just as efficient as the Curtiss. The Liberty is about ten years behind times but has stood the tests of the air exceptionally well during that period. Its day is now over.

From the very start of the science of aviation, it was appreciated that if an air-cooled engine could be obtained that would produce the same power and was just as reliable as the water-cooled types, the efficiency of the airplane would be much greater.

The Wright Whirlwind, most famous of modern radial engines. Lindbergh, Chamberlin and others proved its reliability on their famous long distance flights.

Three types of air-cooled engines were brought out, the rotary, the radial and the Vee. Probably the best of the rotary engines was the Gnome. In this type the cylinders revolved as well as the propeller.

Probably the first of all air-cooled Vee engines to come out was the Renault. This engine was originally a 70 H. P. type. Later it was stepped up to 105 H. P. The development stopped there. Since that time the Liberty has been stripped of its water jackets in an endeavor to secure the saving in weight which the air-cooled types have over the water-cooled. A later development was the inverted Liberty, in which the cylinders were projected downward from the crankshaft.

The advantages in an air-cooled engine over the water-cooled type may be summarized as: great saving in weight, elimination of maintenance troubles in the cooling system, ease of installation, elimination of danger of freezing in cold weather and the ability to warm the engine up much quicker.

In the radial type the cylinders are placed like spokes in a wheel around the crank case. The propeller shaft projects from the center of the engine. Cooling is obtained from metal fins. These fins are metal rings equally spaced around each cylinder. The air flowing between the rings cools the engine.

The flights of Lindbergh, Chamberlin, Byrd, Maitland and Hegenberger and the *Southern Cross* have proved beyond doubt that the air-cooled radial airplane engine is just as reliable and efficient as the water-cooled type.

Power and Weight Factors Limit Size to Which Planes Are Built

Six Liberty motors—four tractors, two pushers—developing a total of 2,400 H. P. were required to get this huge Barling Bomber off the ground. It is one of the largest airplanes ever built, weighing 43,000 pounds when fully loaded. The tail assembly of the ship is as wide as the wings of the ordinary large commercial plane.

THE LIMIT in size of large airplanes has always been a perplexing question. For years designers and constructors have figured out lengths and spans beyond which it will be impracticable to build airplanes. However, just when it is thought that the limit has been reached, a new wing section, a new material, a different method of construction or a new type of engine makes the figures obsolete.

It was thought that the Sikorsky plane of 1914, built in Russia, was the last word in large planes. For its day it was a monster and it carried its heavy load quite well. The World War stopped further advance along such lines although that plane did carry out certain missions during the war until it was wrecked.

Following the war, the United States brought out the Barling Bomber. This was a tri-plane equipped with six Liberty engines, 2,400 horse-power. The pursuit and observation planes looked like mere toys when placed alongside it.

It had a gas tank which seemed to be large enough to be used for the water supply for a small town. It was the largest airplane ever constructed. It flew quite well and made several world's records for weight carrying. However, it was not considered as being of practical military value and no others were ever built. This plane weighed 43,000 pounds when fully loaded. It carried gas for 12 hours when flying with the engines wide open. In the air it gave the impression of being a small village or large barn flying through space.

Today the Germans are bringing out an even larger plane. The Barling was a tri-plane. The German, Romar, is a mono-plane. The Romar has a wing spread of over 100 feet. It has a single hull so constructed that it will withstand considerable battering by water. The Germans hope to fly it around the world.

It will be interesting to see if this giant of the air proves to be more successful than its predecessors. The others, while performing fairly satisfactorily, did not give the results expected or carry loads commensurate with their size. The maintenance was quite a problem. It required a young army to get them in and out of the hangars.

Winners in NEW USE

MODERN MECHANICS pays $10 for every acceptable photo and description of the odd uses to which old Tin Lizzies have been put. The machines shown below are all made from old Model T Fords.

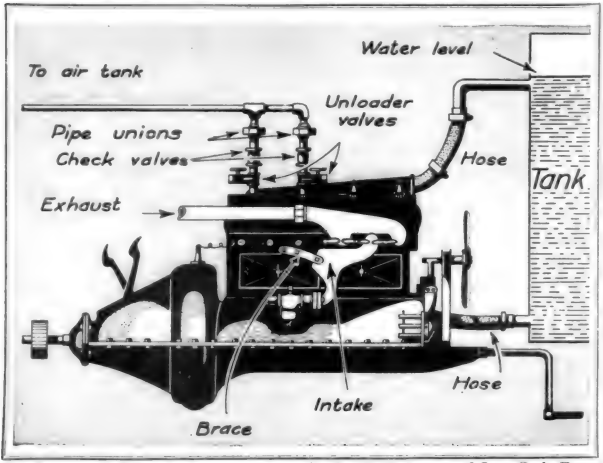
DOWN at Iowa Park, Texas, is an old flivver motor which is enjoying a ripe old age puffing and grunting on half her lungs while the other half supply fresh ozone for tires which have lost the courage of their convictions.

The front two cylinders have been manifolded off from the rest of the motor by the simple expedient of hack-sawing them off where they were not needed, and bunging the ends with welded plate iron.

The intake valves of the rear pair of cylinders were loaded with springs to keep them depressed, and the exhaust valves were brazed in tightly. The spark plug hole was fitted with half-inch pipe and this in turn led to check valves after the air stream had passed by relief or globe valves installed to care for extra high pressure. Once past the check valves the air was conduited by pipe to a storage tank.

A special boiler full of water was provided for the thermo-siphon system, as doing this kind of work was impossible without some adequate means for cooling. If you don't think the motor works to pump air, you ought to see the water steam!

This novel use for an old Ford keeps a garage supplied generously with compressed air.



This ingenious old Ford air compressor won $10 for M. H. Benton, of Iowa Park, Texas

for Old Fords Contest

HYBRID STEAM ROLLER OWES ANCESTRY TO HENRY

MR. G. H. DACY, one of our readers who lives in Maryland, sends us these two views of crazy but useful wrinkles for making use of old Ford car carcasses.

Down at Augusta, Georgia, there is a country club which has extensive acres of greensward running eastward from the piazza of the club house. To keep the grass in good condition it is necessary to roll it. These rollers, one of which is shown in the accompanying shot, were made from old Elizabeths of the vintage of Model T. Six were made at the cost of one ordinary tractor. The conversion is a simple one and the machine performs satisfactorily.

Pulling a lawn conditioner and roller, this hybrid steam roller uses the front elements of a Ford car, the hind wheels of an old tractor, and the roll from an old steam road crusher. Six like it were built at Augusta, Ga.

SERVICEABLE TRACTOR MADE FROM TIN ELIZABETH

ANOTHER Maryland tinkerer put the elements of a tractor around his faithful old brass radiatored Ford. Equipped with sunshades, with gas tank out afront, this flivver is now doing hearty, willing work pulling a disc drag. It is said to be able to pull a "single bottom"—that is, a single plow, with comparative ease. The reader will note that the usual Ford rear axle and housing, together with the usual single spring, are employed to drive the machine. The auto wheels are removed, the frame with the bull wheels put on, and gears intermeshed with the big gear by use of small spur gears on the regular axle.

This old road schooner does work of three horses.

Lost Inside the EARTH

CARRIED to the very center of the earth in a remarkable passenger carrying steel drill, the heroes of this astonishing story emerge in a weird world where they experience extraordinary adventures among the denizens of a land still in the stone age. Don't fail to begin this fascinating serial, the greatest story yet to come from the gifted pen of the world's greatest author of imaginative literature.

I WAS born in Connecticut about thirty years ago. My name is David Innes. My father was a wealthy mine owner. When I was nineteen he died. All his property was to be mine when I attained my majority—provided that I had devoted the two years intervening in close application to the great business I was to inherit.

I did my best to fulfil the last wishes of my parent—not because of the inheritance, but because I loved and honored my father. For six months I toiled in the mines and in the counting-rooms, for I wished to know every minute detail of the business.

We had pierced the Earth's crust!

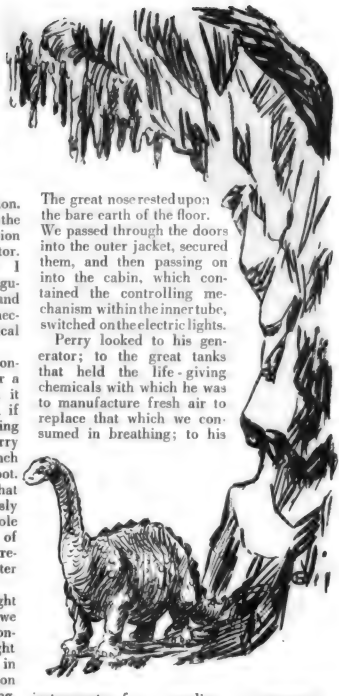
We climbed out of the iron prospector to get our first glimpse of the strange world at the earth's core.

A NOVEL *of the* WORLD *at the* EARTH'S CORE

By

EDGAR RICE BURROUGHS

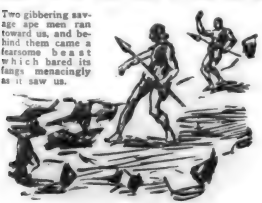
Author of "TARZAN"



Then Perry interested me in his invention. He was an old fellow who had devoted the better part of a long life to the perfection of a mechanical subterranean prospector. As relaxation he studied paleontology. I looked over his plans, listened to his arguments, inspected his working model—and then, convinced, I advanced the funds necessary to construct a full-sized, practical prospector.

I shall not go into the details of its construction. Roughly, it is a steel cylinder a hundred feet long, and jointed so that it may turn and twist through solid rock if need be. At one end is a mighty revolving drill operated by an engine which Perry said generated more power to the cubic inch than any other engine did to the cubic foot. I remember that he used to claim that that invention alone would make us fabulously wealthy—we were going to make the whole thing public after the successful issue of our first secret trial—but Perry never returned from that trial trip, and I only after ten years.

I recall as it were but yesterday the night of that momentous occasion upon which we were to test the practicality of that wondrous invention. It was near midnight when we repaired to the lofty tower in which Perry had constructed his "iron mole," as he was wont to call the thing.



Two gibbering savage ape men ran toward us, and behind them came a fearsome beast which bared its fangs menacingly as it saw us.

The great nose rested upon the bare earth of the floor. We passed through the doors into the outer jacket, secured them, and then passing on into the cabin, which contained the controlling mechanism within the inner tube, switched on the electric lights.

Perry looked to his generator; to the great tanks that held the life-giving chemicals with which he was to manufacture fresh air to replace that which we consumed in breathing; to his instruments for recording temperatures, speed, distance, and for examining the materials through which we were to pass.

He tested the steering device, and overlooked the mighty cogs which transmitted its marvelous velocity to the giant drill at the nose of his strange craft.

Our seats, into which we strapped ourselves, were so arranged upon transverse bars that we would be upright whether the craft were ploughing her way downward into the bowels of the earth, or running horizontally along some great seam of coal, or rising vertically toward the surface again.

The above photograph of Edgar Rice Burroughs was taken in his study just after he had finished his remarkable novel, "Lost Inside the Earth," the great serial story of weird adventure which Modern Mechanics is presenting to its readers, beginning with this issue. Mr. Burroughs' workshop is at Tarazana Ranch, Reseda, California, where he is kept busy writing his fascinating stories to satisfy the demand of eager readers all over the world. His books have been translated into more than a dozen foreign languages.

The Face of Disaster

AT LENGTH all was ready. Perry bowed in prayer. For a moment we were silent, and then the old man's hand grasped the starting lever. There was a frightful roaring beneath us—the giant frame trembled and vibrated—there was a rush of sound as the loose earth passed up through the hollow space between the inner and outer jackets to be deposited in our wake. We were off!

The noise was deafening. The sensation was frightful. For a full minute neither of us could do aught but cling with the proverbial desperation of the drowning man to the handrails of our swinging seats. Then Perry glanced at the thermometer.

"Gad!" he cried, "it cannot be possible—quick! What does the distance meter read?"

That and the speedometer were both on my side of the cabin, and as I turned to take a reading from the former I could see Perry muttering.

"Ten degrees rise—it cannot be possible!" and then I saw him tug frantically upon the steering wheel.

As I finally found the tiny needle in the dim light I translated Perry's evident excitement, and my heart sank within me. But when I spoke I hid the fear which haunted me.

"It will be seven hundred feet, Perry." I said, "by the time you can turn her into the horizontal."

"You'd better lend me a hand then, my boy," he replied, "for I cannot budge her out of the vertical alone. God give that our combined strength may be equal to the task, for else we are lost."

I wormed my way to the old man's side with never a doubt but that the great wheel would yield on the instant to the power of my young and vigorous muscles. Nor was my belief mere vanity, for always had my physique been the envy and despair of my fellows. And for that very reason it had waxed even greater than nature had intended, since my natural pride in my great strength had led me to care for and develop my body and my muscles by every

means within my power. What with boxing, football, and base-ball, I had been in training since childhood.

And so it was with the utmost confidence that I laid hold of the huge iron rim; but though I threw every ounce of my strength into it, my best effort was as unavailing as Perry's had been—the thing would not budge—the grim, insensate, horrible thing that was holding us upon the straight road to death!

Through the Earth's Crust

AT LENGTH I gave up the useless struggle, and without a word returned to my seat. There was no need for words—at least none that I could imagine, unless Perry desired to pray. And I was quite sure that he would, for he never left an opportunity neglected where he might sandwich a prayer. He prayed when he arose in the morning, he prayed before he ate, he prayed when he had finished eating, and before he went to bed at night he prayed again. In between he often found excuses to pray even when the provocation seemed rather far-fetched to my worldly eyes—now that he was about to die I felt positive that I should witness a perfect orgy of prayer—if one may allude with such a simile to so solemn an act.

But to my astonishment I discovered that with death staring him in the face Abner Perry was transformed into a new being. From his lips there flowed—not prayer—but a clear and limpid stream of undiluted profanity, and it was all directed at that quietly stubborn piece of unyielding mechanism.

"I should think, Perry," I chided, "that a man of your professed religiousness would rather be at his prayers than cursing in the presence of imminent death."

"Death!" he cried. "Death is it that appalls you? That is nothing by comparison with the loss the world must suffer. Why, David, within this iron cylinder we have demonstrated possibilities that science has scarce dreamed. We have harnessed a new principle, and with it animated a piece of steel with the power of ten thousand men. That two lives will be snuffed out is nothing to the world calamity that entombs in the bowels of the earth the discoveries that I have made and proved in the successful construction of the thing that is now carrying us farther and farther toward the eternal central fires."

I am frank to admit for myself I was much more concerned with our own immediate future than with any problematical loss which the world might be about to suffer. The world was at least ignorant of its bereavement, while to me it was a real and terrible actuality.

"What can we do?" I asked, hiding my perturbation beneath the mask of a low and level voice.

"We may stop here, and die of asphyxiation when our atmosphere tanks are empty," replied Perry, "or we may continue on with the slight hope that we may later sufficiently deflect the prospector from the vertical to carry us along the arc of a great circle which must eventually return us to the surface. If we succeed in so doing before we reach the higher internal temperature we may even yet survive. There would seem to me to be about one chance in several million that we shall succeed—otherwise we shall die more quickly but no more surely than as though we sat supinely waiting for the torture of a slow and horrible death."

I glanced at the thermometer. It registered 110 degrees. While we were talking the mighty iron mole had bored its way over a mile into the rock of the earth's crust!

Facing Death by Fire

"LET us continue on, then," I replied. "It should soon be over at this rate. You never intimated that the speed of this thing would be so high, Perry. Didn't you know it?"

"No," he answered. "I could not figure the speed exactly, for I had no instrument for measuring the mighty power of my generator. I reasoned, however, that we should make about five hundred yards an hour."

"And we are making seven miles an hour," I concluded for him, as I sat with my eyes upon the distance meter. "How thick is the earth's crust, Perry?" I asked.

"There are almost as many conjectures as to that as there are geologists," was his answer. "One estimates it thirty miles, because the internal heat, increasing at the rate of about one degree to each sixty to seventy feet depth, would be sufficient to fuse the most refractory substances at that

distance beneath the surface. Another finds that the phenomena of precession and nutation require that the earth, if not entirely solid, must at least have a shell not less than eight hundred to a thousand miles in thickness. So there you are. You may take your choice."

"And if it should prove solid?" I asked.

"It will be all the same to us in the end, David," replied Perry. "At the best our oil fuel will suffice to carry us but three or four days, while our atmosphere cannot last to exceed three. Neither, then, is sufficient to bear us in safety through eight thousand miles of rock to the antipodes."

"If the crust is of sufficient thickness we shall come to a final stop between six and seven hundred miles beneath the earth's surface; but during the last hundred and fifty miles of our journey we shall be corpses. Am I correct?" I asked.

"Quite correct, David. Are you frightened?"

"I do not know. It all has come so suddenly that I scarce believe that either of us realizes the real terrors of our position. I feel that I should be reduced to panic; but yet I am not. I imagine that the shock has been so great as to partially stun our sensibilities."

Again I turned to the thermometer. The mercury was rising with less rapidity. It was now 140 degrees, although we had penetrated to a depth of nearly four miles. I told Perry, and he smiled.

"We have shattered one theory at least," was his only comment, and then he returned to his self-assumed occupation of fluently cursing the steering wheel. I once heard a pirate swear, but his best efforts would have seemed like those of a tyro alongside of Perry's masterful and scientific imprecations.

Ninety Miles Down!

ONCE more I tried my hand at the wheel, but I might as well have essayed to swing the earth itself. At my suggestion Perry stopped the generator, and as we came to rest I again threw all my strength into a supreme effort to move the thing even a hair's breadth—but the results were as barren as when we had been traveling at top speed.

I shook my head sadly, and motioned to the starting lever. Perry pulled it toward him, and once again we were plunging downward toward eternity at the rate of seven miles an hour. I sat with my eyes glued to the thermometer and the distance meter. The mercury was rising very slowly now, though even at 145 degrees it was almost unbearable within the narrow confines of our metal prison.

About noon, or twelve hours after our start upon this unfortunate journey, we had bored to a depth of eighty-four miles, at which point the mercury registered 153 degrees F.

Perry was becoming more hopeful, although upon what meager food he sustained his optimism I could not conjecture. From cursing he had turned to singing—I felt that the strain at last affected his mind.

"What are the readings now, David?" Perry's voice broke in upon my somber reflections.

"Ninety miles and 153 degrees," I replied.

"Gad, but we've knocked that thirty-mile crust theory into a cocked hat!" he cried gleefully.

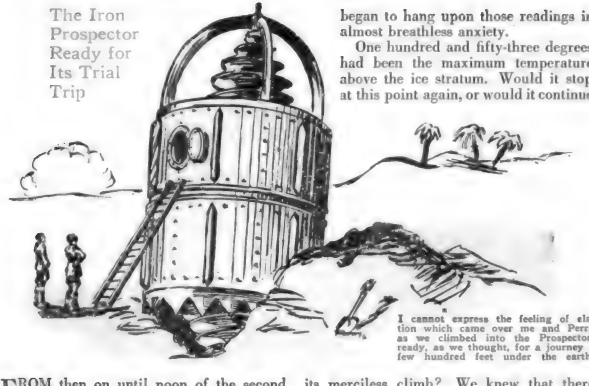
"Precious lot of good it will do us," I growled back.

"But, my boy," he continued, "doesn't that temperature reading mean anything to you? Why, it hasn't gone up in six miles. Think of it, son!"

"Yes, I'm thinking of it," I answered: "but what difference will it make when our air supply is exhausted whether the temperature is 153 degrees or 153,000? We'll be just as dead, and no one will know the difference, anyhow."

But I must admit that for some unaccountable reason the stationary temperature did renew my waning hope. The very fact, as Perry took pains to explain, of the blasting of several very exact and learned scientific hypotheses made it apparent that we could not know what lay before us within the bowels of the earth, and so we might continue to hope for the best, at least until we were dead—when hope would no longer be essential to our happiness.

At one hundred miles the temperature had *dropped to 152½ degrees!* When I announced it Perry reached over and hugged me.



The Iron Prospector Ready for Its Trial Trip

I cannot express the feeling of elation which came over me and Perry as we climbed into the Prospector, ready, as we thought, for a journey a few hundred feet under the earth.

began to hang upon those readings in almost breathless anxiety.

One hundred and fifty-three degrees had been the maximum temperature above the ice stratum. Would it stop at this point again, or would it continue its merciless climb? We knew that there was no hope, and yet with the persistence of life itself we continued to hope against practical certainty.

FROM then on until noon of the second day it continued to drop until it became as uncomfortably cold as it had been unbearably hot before. At a depth of two hundred and forty miles our nostrils were assailed by almost overpowering ammonia fumes, and the temperature had dropped to *ten below zero!* We suffered nearly two hours of this intense and bitter cold, until at about two hundred and forty-five miles from the surface of the earth we entered a stratum of solid ice, when the mercury quickly rose to 32 degrees. During the next three hours we passed through ten miles of ice, eventually emerging into another series of ammonia-impregnated strata, where the mercury again fell to ten degrees below zero.

Slowly it rose once more until we were convinced that at last we were nearing the molten interior of the earth. At four hundred miles the temperature had reached 152 degrees. Feverishly I watched the thermometer. Slowly it rose. Perry had ceased singing and was at last praying.

Our hopes had received such a deathblow that the gradually increasing heat seemed to our distorted imaginations much greater than it really was. For another hour I saw that pitiless column of mercury rise and rise until at four hundred and ten miles it stood at 153 degrees. Now it was that we

Already the air tanks were at low ebb—there was barely enough of the precious gases to sustain us for another twelve hours. But would we be alive to know or care? It seemed incredible.

At four hundred and twenty miles I took another reading.

"Perry!" I shouted. "Perry, man! She's going down! She's going down! She's 152 degrees again."

"Gad!" he cried. "What can it mean? Can the earth be cold at the center?"

"I do not know, Perry!" I answered; "but thank God, if I am to die it shall not be by fire—that is all that I have feared. I can face the thought of any death but that."

DOWN, down went the mercury until it stood as low as it had seven miles from the surface of the earth, and then of a sudden the realization broke upon us that death was very near. Perry was the first to discover it. I saw him fussing with the valves that regulate the air supply. And at the same time I experienced difficulty in breathing. My head felt dizzy—my limbs heavy.

I saw Perry crumple in his seat. He gave

himself a shake and sat erect again. Then he turned toward me.

"Good-bye, David," he said, "I guess this is the end," and then he smiled and closed his eyes.

"Good-bye, Perry, and good luck to you," I answered, smiling back at him. But I fought off that awful lethargy. I was very young—I did not want to die.

For an hour I battled against the cruelly enveloping death that surrounded me upon all sides. At first I found that by climbing high into the framework above me I could find more of the precious life-giving elements, and for a while these sustained me. It must have been an hour after Perry had succumbed that I at last came to the realization that I could no longer carry on this unequal struggle against the inevitable.

With my last flickering ray of consciousness I turned mechanically toward the distance meter. It stood at exactly five hundred miles from the earth's surface—and then of a sudden the huge thing that bore us came to a stop. The rattle of hurtling rock through the hollow jacket ceased. The wild racing of the giant drill betokened that it was running loose in *air*—and then another truth flashed upon me. The point of the prospector was *above* us. Slowly it dawned on me that since passing through the ice strata it had been above. We had turned in the ice and sped upward toward the earth's crust. Thank God! We were safe!

I put my nose to the intake pipe through which samples were to have been taken during the passage of the prospector through the earth, and my fondest hopes were realized—a flood of fresh air was pouring into the iron cabin. The reaction left me in a state of collapse, and I lost consciousness.

We Leave Our Prison

I WAS unconscious little more than an instant, for as I lunged forward from the crossbeam to which I had been clinging, and fell with a crash to the floor of the cabin, the shock brought me to myself.

My first concern was with Perry. I was horrified at the thought that upon the very threshold of salvation he might be dead. Tearing open his shirt I placed my ear to his breast. I could have cried with relief—his heart was beating quite regularly.

At the water tank I wetted my handkerchief, slapping it smartly across his forehead and face several times. In a moment I was rewarded by the raising of his lids. For a time he lay wide-eyed and quite uncomprehending. Then his scattered wits slowly foregathered, and he sat up sniffing the air with an expression of wonderment upon his face.

"Why, David," he cried at last, "it's air, as sure as I live. Why—why what does it mean? Where in the world are we? What has happened?"

"It means that we're back at the surface all right, Perry," I cried; "but where, I don't know. I haven't opened her up yet. Been too busy reviving you. Lord, man, but you had a close squeak!"

"You say we're back at the surface, David? How can that be? How long have I been unconscious?"

"Not long. We turned in the ice stratum. Don't you recall the sudden whirling of our seats? After that the drill was above us instead of below. We didn't notice it at the time; but I recall it now."

"You mean to say that we turned back in the ice stratum, David? That is not possible. The prospector cannot turn unless its nose deflected. If the nose were deflected from the outside—by some external force or resistance—the steering wheel within would have moved in response. The steering wheel has not budged, David, since we started. You know that."

I did know it; but here we were with our drill racing in pure air, and copious volumes of it pouring into the cabin.

"We couldn't have turned in the ice stratum, Perry, I know as well as you," I replied; "but the fact remains that we did, for here we are this minute at the surface of the earth again, and I am going out to see just where."

"Better wait till morning, David—it must be midnight now."

I glanced at the chronometer.

"Half after twelve. We have been out seventy-two hours, so it must be midnight. Nevertheless I'm going to have a look at the blessed sky that I had given up all hope of ever seeing again," and so saying I lifted the bars from the inner door, and swung it open. There was quite a quantity of loose

material in the jacket, and this I had to remove with a shovel to get at the opposite door in the outer shell.

In a short time I had removed enough of the earth and rock to the floor of the cabin to expose the door beyond. Perry was directly behind me as I threw it open. The upper half was above the surface of the ground. With an expression of surprise I turned and looked at Perry—it was broad daylight without!

A Horizonless World

"SOMETHING seems to have gone wrong either with our calculations or the nometer," I said. Perry shook his head—there was a strange expression in his eyes.

"Let's have a look beyond that door, David," he cried.

Together we stepped out to stand in silent contemplation of a landscape at once weird and beautiful. Before us a low and level shore stretched down to a silent sea. As far as the eye could reach the surface of the water was dotted with countless tiny isles—some of towering, barren, granitic rock—others resplendent in gorgeous trappings of tropical vegetation, myriad starred with the magnificent splendor of vivid blooms.

Behind us rose a dark and forbidding wood of g i a n t arborescent ferns intermingled with the commoner types of a primeval tropical forest. Huge creepers depended in great loops from tree to tree, dense underbrush overgrew a tangled mass of fallen trunks and branches. Upon the outer verge we could see the same splendid coloring of countless blossoms that glorified the islands, but within the dense shadows all seemed dark and gloomy as the grave.

And upon all the noonday sun poured its torrid rays out of a cloudless sky.

"Where on earth can we be?" I asked, turning to Perry.

For some moments the old man did not reply. He stood with bowed head, buried in deep thought. But at last he spoke.

"David," he said, "I am not so sure that we are *on* earth."

"What do you mean, Perry?" I cried. "Do you think that we are dead, and that this is heaven?"

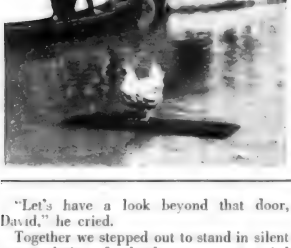
He smiled, and turning, pointed to the nose of the prospector protruding from the ground at our backs.

"But for that, David, I might believe that we were indeed come to the country beyond the Styx. The prospector renders that theory untenable—it, certainly, could never have gone to heaven. However, I am willing to concede that we actually may be in another world from that which we have always known. If we are not *on* earth, there is every reason to believe that we may be *in* it."

As we walked along the beach Perry gazed long and earnestly across the water. Evidently he was wrestling with a mighty problem.

"David," he said abruptly, "do you perceive anything unusual about the horizon?"

As I looked I began to appreciate the reason for the strangeness of the landscape that had haunted me from the first with an illusive suggestion of the bizarre and unnatural—*there was no horizon!*



HEN BRAVES FLOOD

ONE of the refugees in the recent Mississippi flood was an old Plymouth Rock hen who floated around on her boxboard raft until she was rescued. The photograph shows biddy registering joy as her owner approaches in a canoe. The hen may be seen to be wearing a complacent, self-satisfied expression, but it must be explained in extenuation that it's a rare chick which grows up to become captain, first mate, and roustabout of her own Mississippi steamer!

Where Are We?

AS FAR as the eye could reach out the sea continued and upon its bosom floated tiny islands, those in the distance reduced to mere specks; but ever beyond them was the sea, until the impression became quite real that one was *looking up* at the most distant point that the eye could fathom—the distance was lost in the distance. That was all—there was no clear-cut horizontal line marking the dip of the globe below the line of vision.

"A great light is commencing to break on me," continued Perry, taking out his watch. "I believe that I have partially solved the riddle. It is now two o'clock. When we emerged from the prospector the sun was directly above us. Where is it now?"

I glanced up to find the great orb still motionless in the center of the heavens. And such a sun! I had scarcely noticed it before. Fully thrice the size of the sun I had known throughout my life, and apparently so near that the sight of it carried the conviction that one might almost reach up and touch it.

"My God, Perry, where are we?" I exclaimed. "This thing is beginning to get on my nerves."

"I think that I may state quite positively, David," he commenced, "that we are—" but he got no further. From behind us in the vicinity of the prospector there came the most thunderous, awe-inspiring roar that ever had fallen upon my ears. With one accord we turned to discover the author of that fearsome noise.

Had I still retained the suspicion that we were on earth the sight that met my eyes would quite entirely have banished it. Emerging from the forest was a colossal beast which closely resembled a bear. It was fully as large as the largest elephant, and with great forepaws armed with huge claws. Its nose, or snout, depended nearly a foot below its lower jaw, much after the manner of a rudimentary trunk. The giant body was covered by a coat of thick, shaggy hair.

Roaring horribly it came toward us at a ponderous, shuffling trot. I turned toward Perry to suggest that it might be wise to seek other surroundings—the idea had evidently occurred to Perry previously, for he was already a hundred paces away, and with each second his prodigious bounds increased the distance.

I SAW that he was headed toward a little point of the forest which ran out toward the sea not far from where we had been standing, and as the mighty creature, the sight of which had galvanized him into such

ORNITHOPTER IS BIRD-LIKE PLANE

AN UNUSUAL type of ornithopter plane, or one which is designed after the lines of a bird, has recently been completed by a London inventor. The model bears a very strong resemblance to a moth or giant dragon fly, as may be seen by a glance at the photograph. It is notable that the first efforts of man to construct a flying machine resulted from a study of birds in flight, and naturally it was thought that if man ever invented a machine which flew, he must adapt the principle of flapping bird wings to his own use. However, up to date the flapping wing planes have been failures. One of the most recent experiments in this field was the American Eagle plane described in Modern Mechanics for December. This plane crashed on its trial flight.

remarkable action, was forging steadily toward me. I set off after Perry, though at a somewhat more decorous pace.

It was evident that the massive beast pursuing us was not built for speed, so all that I considered necessary was to gain the trees sufficiently ahead of it to enable me to climb to the safety of some great branch before it came up.

Notwithstanding our danger I could not help but laugh at Perry's frantic capers as he essayed to gain the safety of the lower branches of the trees he now had reached. The stems were bare for a distance of some fifteen feet—at least on those trees which Perry attempted to ascend, for the suggestion of safety carried by the larger of the forest giants had evidently attracted him to them. A dozen times he scrambled up the trunks like a huge cat only to fall back to the ground once more, and with each failure he cast a horrified glance over his shoulder at the oncoming brute, simultaneously emitting terror-stricken shrieks that awoke the echoes of the grim forest.

At length he spied a dangling creeper about the bigness of one's wrist, and when I reached the trees he was racing madly up it, hand over hand. He had almost reached the lowest branch of the tree from which the creeper depended when the thing parted beneath his weight and he fell sprawling at my feet.

The beast was already too close to us for comfort. Seizing Perry by the shoulder I dragged him to his feet, and rushing to a small tree—one that he could easily encircle with his arms and legs—I boosted him as far up as I could, and then left him to his fate, for a glance over my shoulder revealed the awful beast almost upon me.

It was the great size of the thing alone that saved me. Its enormous bulk rendered it too slow upon its feet to cope with the agility of my young muscles, and so I was enabled to dodge out of its way and run completely behind it before its slow wits could direct it in pursuit.

The few seconds of grace that this gave me found me safely lodged in the branches of a tree a few paces from that in which Perry had at last found a haven.

Did I say safely lodged? At the time I thought we were quite safe, and so did Perry. He was praying—raising his voice in thanksgiving at our deliverance—and had just completed a sort of paeon of gratitude that the thing couldn't climb a tree when without warning it reared up beneath him on its enormous tail and hind feet, and reached those fearfully armed paws quite to the branch upon which he crouched.

The accompanying roar was all but drowned in Perry's scream of fright, and he came near tumbling headlong into the gaping jaws beneath him, so precipitate was his impetuous haste to vacate the dangerous limb. It was with a deep sigh of relief that I saw him gain a higher branch in safety.

In the Clutch of the Brute

AND then the brute did that which froze us both anew with horror. Grasping the trunk of Perry's tree with his powerful paws, he dragged down with all the great weight of his huge bulk and the irresistible force of those mighty muscles. Slowly, but surely, the stem began to bend toward him.

Inch by inch he worked his paws upward as the tree leaned more and more from the perpendicular. Perry clung chattering in a panic of terror. Higher and higher into the bending and swaying tree he clambered. More and more rapidly was the tree top inclining toward the ground.

I saw now why the great brute was armed with such enormous paws. The use that he was putting them to was precisely that for which nature had intended them. The sloth-like creature was herbivorous, and to feed that mighty carcass entire trees must be stripped of their foliage.

Realizing that I could outdistance the clumsy brute in the open, I was intent only on distracting the thing's attention from Perry long enough to enable the old man to gain the safety of a larger tree. There were many close by which not even the terrific strength of that titanic monster could bend.

As I touched the ground I snatched a broken limb from the tangled mass that matted the jungle-like floor of the forest and, leaping unnoticed behind the shaggy

(Continued on page 186)

Join this Toy Motor CONTEST!

FIRST PRIZE, SILVER CUP AND.....$25
SECOND PRIZE $10
THIRD, FOURTH AND FIFTH PRIZES....$ 5

WELL, here's one for the electricians! If you have ever "monkeyed" with electrical hook-ups you must have come upon a pet scheme for building the world's simplest electric motor, and here is a chance for you to let the world in on the discovery! It will probably pay you big dividends by letting the world know that your genius has come to light.

Send us a photo and a wiring diagram for entry in the Modern Mechanics "Simplest Toy Motor" contest so that it will arrive at the editorial offices of the magazine on or before March 1st, 1929. A committee of expert tinkerers will pass upon the merits of the model you have built as shown by the photo and indicated by the simplicity of the idea. This contest is in the nature of a "rudimentary" contest—we want to call forth, for all our readers to see, the simplest electric motor that can be made. Here are the rules:

This cup and $25 cash goes to the winner of this toy motor contest!

1. Modern Mechanics will offer a prize of a silver cup and $25, a second prize of $10, and third, fourth and fifth prizes of $5 each for the plans and photos of the simplest electric motor it is possible to build and run on battery current. The photos and diagrams must reach the editorial offices of Modern Mechanics on or before March 1st, 1929, in order to be eligible.

2. Decision of the judges, Charles Magee Adams, Radio Editor, J. C. Smalley, and A. Lockhart, will be final.

3. In case of a tie a duplicate cup and prizes will be awarded tying contestants.

4. Awards will be made on the basis of simplicity of idea, simplicity of construction, and upon the excellence of photos submitted. Age of the contestant has no bearing upon the selection of the judges.

5. The right is reserved to publish winning photos in Modern Mechanics, together with hookups and drawings showing the construction of the motors.

6. Entries must be securely wrapped with envelopes and stamps included for their return if the contestant wishes the entry returned. Modern Mechanics assumes no liability for damage to manuscripts in transit, and will promptly return photos and plans which do not win shortly after the close of the contest, providing all regulations as to postage and return envelopes are met.

All right now, fans. Get busy!

Meet the Model Airplane CONTEST WINNERS!

A HIGH degree of craftsmanship was displayed by all the numerous entrants in Modern Mechanics' Model Airplane Contest, just closed. The five prize winners are announced below.

Stephen Kurtycz

STEP UP, folks, and meet Stephen Kurtycz, who walked off with first prize of $25 and a handsome engraved trophy cup in Modern Mechanics' Model Airplane Contest, which ended December 1. Mr. Kurtycz's picture appears at the left. Below is shown a view of his handsome R. O. G. model with prop twirling just after the take-off. His little monoplane is a fine example of craftsmanship and airworthiness.

The contest editors were hard put to it to decide the five prize winners from the flood of entries which poured in following announcement of the contest. Big planes, little planes, monoplanes, biplanes, tractors and pushers—every conceivable type of airplane model poured into our offices, demonstrating conclusively that the country is thoroughly air-minded. What's more, practically without exception the models were carefully built and indicated that their makers possessed a well-grounded understanding of aerodynamic principles.

Mr. Kurtycz, the first prize winner, lives at 16 Parker St., Indian Orchard, Mass. Second prize of $10 went to Ralph Jeska, 3710½ Grand Ave., West Duluth, Minn. His model also was a monoplane, as were a large number of other entries, indicating the popularity of this type of ship which has been steadily growing since Lindbergh made his famous flight.

Stephen Kurtycz's prize winning model is shown above in flight.

Third, fourth, and fifth prizes of $5 each were distributed as follows: Fritz Weber of Wayzata, Minn., took third prize with his model of Lindbergh's Spirit of St. Louis. Particularly worthy of comment was the excellent rubber-tired landing gear on Mr. Weber's plane, as well as the hand-fashioned metal propeller.

Robert Loper, 1400 Boswell Ave., Topeka, Kansas, was winner of fourth prize. His plane was one of the largest models submitted, with a wing spread of about 18 inches, but it proved to be a neat performer in the air, with an astonishing amount of reserve power in its sturdy rubber motor.

Fifth prize was won by Orlando Laukandt, 1234 W. 6th St., Red Wing, Minn. His model was one of the most unusual submitted and showed great originality of design. The wing and tail assembly was shaped after the lines of a bird and cleverly painted in red, gold and green so that it was indeed a beauty. A tin propeller was used.

Great skill was demonstrated in the carving of wooden propellers with which a great number of entries were powered, testifying to many hours of painstaking work. Indeed, the contest editors were impressed with the high level of craftsmanship displayed in fashioning models which were surprisingly sturdy despite their light weight.

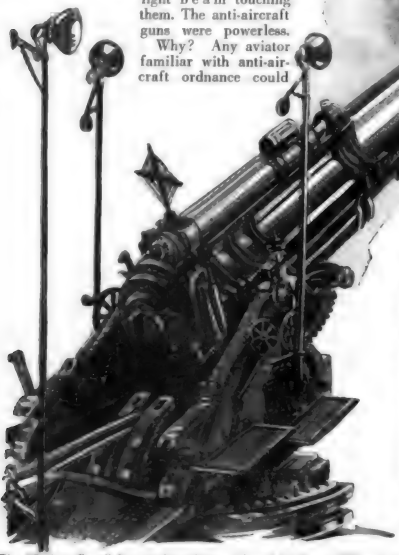
Automatic Aiming Cannon

New anti-aircraft gun aims itself by sounding device to guard America from air raiders.

PEOPLE who lived in London during the late World War will vividly recall the feeling of helplessness that possessed them when Germany bombed that city on several occasions.

They will tell you that the murderous cargoes of bombs were dropped from Zeppelins and Gothas which cruised the thin upper realms of the heavens with nothing more harmful than an occasional searchlight beam touching them. The anti-aircraft guns were powerless.

Why? Any aviator familiar with anti-aircraft ordnance could tell you. He would laugh at the thought of an anti-aircraft gun actually scoring a direct hit. Planes brought down by shrapnel from the ground were planes that were just "in the way," he would tell you. And he was right—about those old anti-aircraft guns. But he would be wrong about the new "Robot Gun," and well might he change the tone of his argument, for the new weapon is well nigh invincible, according to authorities in the army. What happened to London can never happen to America, they say. Here is the reason. There will be guarding all of America's strategic cities batteries of guns which automatically and instantaneously compute trajectory, wind density, elevation and speed at which the target is moving, and which can hit aircraft too far away for the eye to see! These guns function through the



The "Robot Gun," from microphones placed at three different points as shown in the above drawing, can aim itself instantaneously and score very nearly 100 per cent hits, as shown at Aberdeen Proving Grounds last month. It makes allowance for speed of objective and for wind.

Could Hit Invisible Aircraft

Brought Down by the Hum of its Own Motors

medium of a new device called a torque amplifier, which automatically "lays" the gun, as field parlance has it. From three points, which define the plane in which the target is moving, ears gather the sibilant sounds of a distant motor. Instantly, as to a human brain, nerves of wire and stimuli of electricity instruct the torque amplifier as to the location of the target. With the speed of Electra the gun is aimed and fired. Not an attendant is near. The gun functions until a hit kills the droning of the motors.

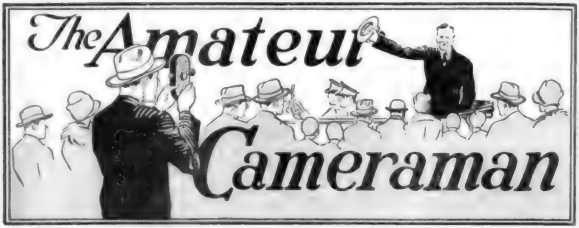
With the old anti-aircraft guns data required for laying the guns were telephoned from a central station to the men directing them. Numerous instruments had to be used in observing the planes and computing the firing data. So many men were required to receive all the information and set the scales that not merely one but many errors resulted.

Then, after all was done the low velocity of the shells and the speed of the planes caused the projectile usually to be late in arriving where the plane had been, if it got that far. Little improvement was made over that system for some years after the war.

Today through the use of the equipment devised by the late Major W. P. Wilson of the Ordnance Bureau, the electrically controlled robot guns, which are three-inch pieces, are being proved through tests conducted at Aberdeen Proving Grounds, Maryland.

Army officers regard the new guns as almost human, in the same way people speak of the linotype and the adding machine; even more than human, because they minimize the effect of errors by the personnel.

It is predicted that a new day has dawned in the use of anti-aircraft ordnance, and that America will be immune from any attack by airplanes, formidable as the winged explosive carriers may be!



Edited by WALTER D. KERST

AS AN associate member of the Society of Motion Picture Engineers, Mr. Kerst is nationally known as an expert on the technical aspects of movie making. This month he discusses in this department several interesting ways in which the amateur movie maker can secure novel effects with his camera.

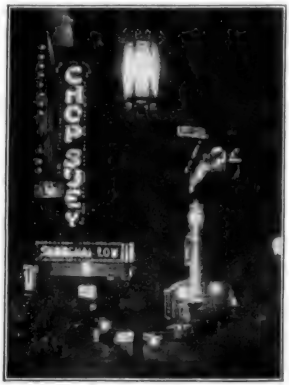
Night Shots Appeal to All Amateur Camera Men

THE amateur movie maker who does not use his camera for night scenes, particularly in the large cities, is missing a whole lot of fun and some mighty interesting films. Such scenes are easy to make and will help to round out reels of daylight shots of the same scenes.

Contrary to the usual supposition, an extremely fast lens and much special equipment is not usually necessary to produce very satisfactory night shots.

A fast lens will give one a wide range of subjects, but the normal f.3.5 lens can also be used under certain conditions. The fast f.1.5 lens will give more detail in the halftones than the f.3.5, but these can often be sacrificed where they are unimportant or entirely lacking as in shots of fireworks displays, search-lights sweeping the skies, etc. For the crowded streets of a large city, with its masses surging back and forth in the glare of the street lamps and theatrical signs, the f.1.5 gives remarkable detail.

It is preferable to shoot at normal speed rather than half speed so that the motion will not be accelerated. Remember that f.1.5 is a tremendous aperture and that the depth of focus is very slight. It is necessary to focus carefully on every shot. Do not include objects nearer than 15 or 20 feet to the lens when shooting at this opening or the results will be blurry. When



Night scenes in a lighted city street are especially effective for amateur shots.

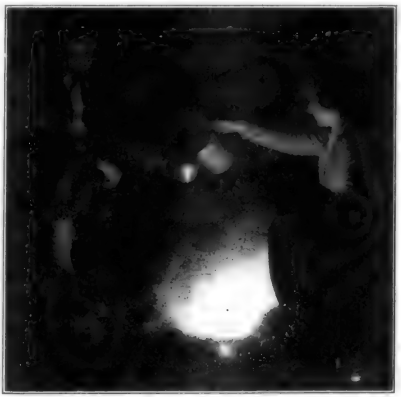
Flares Provide Striking Campfire Shots With Ordinary Movie Film

using the f.3.5 for night work, a half speed of the film in the camera, or 8 exposures a second instead of 16, is desirable, so as to insure the fullest exposure possible.

Night work is by no means limited to the amateur in the large city. Particularly is this true in the winter, when the snow lies heavily on the ground. A corner in the little town, illuminated by the corner arc lamp, plus the bright reflection from the snow, will give some interesting silhouette effects. An f.1.5 lens and half speed of the film is necessary here. Do not attempt to get detail but place the subjects between the light source and the lens, so that they will be in silhouette.

Another interesting night shot is that of a camp-fire. The fire, with the figures silhouetted before it or placed at the side so that the glare of the flames will light up the faces, will be most realistic on the screen. With the f. 1.5 lens, camera at half speed, and panchromatic film, a good picture can be secured.

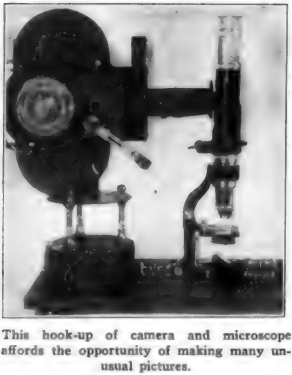
When using only the ordinary film, which is not sensitive to the red and yellow of the flames, it will be necessary to use one or two flares in a hole dug in the ground, directly beneath the fire. The flares burn a sufficient length of time for photographing a normal scene. The white smoke given off during their burning will add to the effect. Flares may be purchased at small cost.



This campfire scene illustrates another effective night picture. Using panchromatic film, with the camera at half speed, satisfactory results can be obtained.

SEEING IS BELIEVING

MANUFACTURERS of all kinds, particularly those of commodities that are too bulky or that cannot be shown by their salesmen to prospective buyers, are turning more and more to the 16 mm. film and projector as a selling agent. Take the manufacturers of farm tractors, for instance. Heretofore the salesman had only his vocabulary and a few small pictures in a catalog, perhaps, with which to sell his prospect. It would hardly be practical for him to have a tractor shipped a great distance to help close a sale. But the next best thing to the tractor itself is a movie of it in operation, that can be run off for the prospective buyer right in his office, with a minimum of time and trouble. With his compact portable 16 mm. projector and a little daylight screen that fits in the case with the projector, he brings the most conclusive argument possible right to the buyer's desk. It is needless to repeat that "seeing is believing," and that this method of salesmanship is gaining great popularity in the industrial field. Also more concerns each day are using the 16 mm. movie as an advertising medium, as through it they can reach a tremendous field in a manner that cannot be surpassed in any other way. A few years hence will probably see a large number of concerns offering



This hook-up of camera and microscope affords the opportunity of making many unusual pictures.

16 mm. subjects showing their products. The Gorham Silver Company recently inaugurated the distribution to amateurs of many 16 mm. prints of an excellent three-reel subject showing the making of their silver and bronze products. Other concerns are falling in line and it will not be long before all the manufacturers of America will be sold on the idea that "seeing is believing."

FINE POINTS IN PROJECTION

In projecting your film, you have no doubt noticed that some scenes, denser than others, held back a lot of light from the screen, while others let a lot of light through to the screen. By using the rheostat control on your projector during the showing of the film, you can control the amount of light reaching the screen. When a dense scene appears, crowd all the light possible through the film by pushing the ammeter dial up to its full amount. Likewise, reduce it to its lowest reading when the film image is thin. By varying the projector light in this way, you can get a professional-like showing and one that is much better than if the projector is started and left alone until the reel has been run.

Here's another little refinement. When setting up your screen and projector to get the proper size image to fit the screen, make the throw of the projector so that the edges of the picture all around will extend slightly over the black frame or border surrounding the screen. The black will "kill" the light from the picture on it, and the picture will frame very nicely on the screen.

Do not place the screen too low in relation to the eye-level of your audience and do not place the first row too near the screen. If you are using a glass bead screen, keep your audience confined to within a narrow angle in front of it. This is because quite a percentage of light is lost to those viewing a picture from an extreme angle with this type of screen. When using an aluminum screen the audience can be spread out at more of an angle, as this is a diffusing surface, and spreads the light considerably.

MAKING MICRO MOVIES

A FASCINATING pastime for the amateur during the winter months is that of making microscopic movies. This type of shooting is increasing greatly among movie enthusiasts and they are getting no end of fun and education from it. An interesting use to which the microscope and the 16 mm. camera has been put recently is that of taking micro-movies of uncut diamonds so as to detect any flaws in the stones. This is far superior to taking still micro pictures as the stone can be turned in every conceivable way while being photographed, leaving no possibility for the flaw to escape the microscope's all-seeing eye.

The illustration shows a 16 mm. camera attached to the microscope by means of the Microphote, or microscope adapter, the reflex focuser, for focusing the image sharply, and the microstage, holding in this case, a prepared slide with specimen. A strong light is directed by the reflecting mirror beneath the stage. This mirror throws the light upward, illuminating the subject on the slide.

Focusing is done through the eyepiece set near the front of the camera. The camera is equipped with the hand crank so that speed of the film may be controlled to obtain correct exposure. In making micro-movies the camera lens is removed, the lens of the microscope serving instead.

Camera Works on Wheel Spoke to Show Poker Faces

A complete panoramic shot of the players at a poker game was obtained with the help of the device shown above, used in a recent professional film production. The camera was mounted on the wooden merry-go-round with its axis fastened to the center of the table. Small rubber tired wheels supported the arm and enabled it to travel smoothly on its journey around the table. The long wooden arm passed over the heads of the players and also served to hold the wire attached to the motor on the camera.

HINTS FOR TELEPHOTO WORK

Always use a filter when making telephoto shots.

Make telephoto pictures only on d a y s when the atmosphere is clear as crystal. Otherwise the haze in the air will destroy definition.

Always use a tripod when making shots with three, four and six inch lenses.

Try a closeup of a person with a four or six inch lens. Due to the distance of the camera, all camera consciousness and nervousness will disappear.

Be sure you do not use too long a telephoto lens on subjects too near the camera. Remember that the field of view is narrowed considerably as you increase t h e f o c a l length of the lens, and you are liable to eliminate an important part of the scene.

Under-expose telephoto shots slightly so as to increase the contrast.

Focus all telephoto shots accurately, as a slight error will mean the difference between success and failure.

QUESTIONS AND ANSWERS

Q. How can I make a fade-out with my 16 mm. camera?—R. P. S.

A. This is done by manipulating the lens diaphragm, while shooting a scene. To get a fade-out or in of proper length it is necessary that the scene call for an exposure of f. 5.6 or more. To fade in, press the button with the hand held over the lens and the diaphragm set at f. 16. Slowly remove your hand and then slowly open the diaphragm stop to the proper setting for the scene. To fade out reverse the action, bringing the hand over the lens at the end so as to exclude all light from the film.

Q. How often should I oil my projector?—L. M. T.

A. Get in the habit of oiling your projector each time after running three 400-foot reels. Don't squirt the oil into the holes but merely put a drop in each one. Too much oil is almost as detrimental as too little. It will get on your film and ruin it. Wipe sprockets, idlers and the film channel with a soft, lintless rag after oiling.

New Fountain Pen Umbrella is Latest From Paris

PARIS, the creating source of the latest fashions, sent this new fountain-pen umbrella to America recently. This very new device is merely a standard umbrella with a hollow handle. A top is screwed onto the handle, making it a container into which a regular fountain pen is placed. Truly it is a modern idea, for the carrying of a fountain pen is a problem that has vexed many of us. Women especially appreciate this idea because the average pen is too large to carry in the purse, while a small one is not large enough to be of practical value. There are no two items of personal property that are as subject to loss as the umbrella and the fountain pen. Here are both of them in the same combination. If one is lost so is the other. Of course with two such "loseable" objects together, the owner should be able to keep them at hand. The device cannot be distinguished from an ordinary umbrella.

Above is shown the top of the umbrella removed to show the complete fountain pen.

NEW MOTORCYCLE CAN ATTAIN SPEED OF 100 M. P. H!

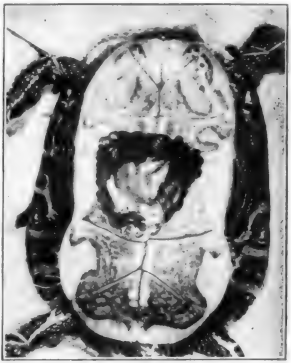
RECENTLY the Ascot Paulhan Co., of London, announced a new model motorcycle that is attracting wide attention. This machine is of the conventional type but has been vastly improved both in appearance and in mechanical make-up. The most noteworthy of these changes is the new panel of instruments that is placed neatly between the handle bars. The windshield is formed as a part of the front panel and is divided into two parts. The upper half can be adjusted to fit the height of the rider. A windshield wiper is standard equipment.

Above in the circle is a view of the dash board arrangement on the new Ascot Paulhan motorcycle. The novel windshield is adjustable for height. The rider posed on the machine shows how comfortable it is to ride. The compact neatness of the mechanism is a special feature, for all parts are completely enclosed in metal shields.

Turtle's Heartbeats Studied Under New Camera

CARL DAME CLARKE, medical illustrator at the University of Maryland, found a turtle a very fine specimen for study with the new camera that he has invented. The turtle has been very carefully cut away so that the viscera is shown. The action of the heart, kidneys and stomach can then be observed. This camera is fitted with a clock and a very high power microscope which can be so adjusted that the number of heart beats can be counted by actual photographic count. This method of study also allows the medical man to judge the condition of the viscera under observation.

The movie camera plays the most important role in this new method of scientific study. By means of the high speed camera slow motion type of pictures may be taken. The slow motion picture is of untold value to the observer, for he can study the very fine palpitations that could never be seen otherwise.



RACING CAR TAKES THE LEAP FOR LIFE AT 100 M. P. H.

WHILE roaring around the Motor Parkway track at Mineola, Long Island, New York, the racing car of William Darragh took matters of direction into its own hands. Darragh was taking part in a six-lap elimination race at the Mineola Fair. During the second lap his car skidded, and rearing like a broncho slammed into an adjacent iron fence. The fence was smashed but the speed of the car was sufficient to carry it past the bank. A lucky twist of fate kept the crashing car on its wheels and it stopped in the deep straw that was piled on the outside of the track. The people who had gathered at this point rushed to the aid of Darragh, expecting to find him dead. He was neither dead nor badly injured. A close examination revealed merely a badly lacerated nose.

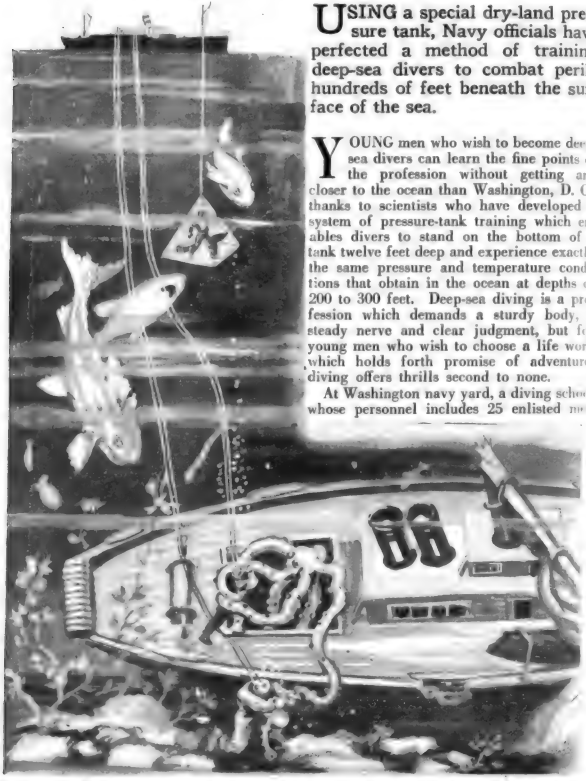
This dare-devil driver missed death by inches when his car crashed thru the embankment at terrific speed. The car cleared the fence and came down on the other side without turning over or smashing up.

Training Divers to FIGHT

USING a special dry-land pressure tank, Navy officials have perfected a method of training deep-sea divers to combat perils hundreds of feet beneath the surface of the sea.

YOUNG men who wish to become deep-sea divers can learn the fine points of the profession without getting any closer to the ocean than Washington, D. C., thanks to scientists who have developed a system of pressure-tank training which enables divers to stand on the bottom of a tank twelve feet deep and experience exactly the same pressure and temperature conditions that obtain in the ocean at depths of 200 to 300 feet. Deep-sea diving is a profession which demands a sturdy body, a steady nerve and clear judgment, but for young men who wish to choose a life work which holds forth promise of adventure, diving offers thrills second to none.

At Washington navy yard, a diving school whose personnel includes 25 enlisted men



Battles with sharks, octopuses, and other marine monsters are not the least of the perils the deep-sea diver must contend with. The possibility of the life-line becoming entangled, or of something going wrong with the air pumps which supply his oxygen, is an everpresent danger which divers accept as a matter of course.

Undersea PERILS

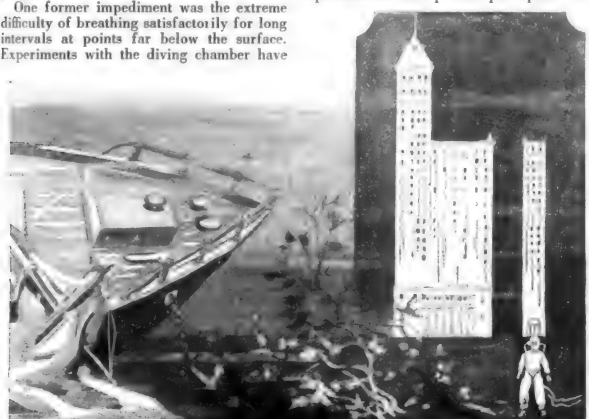
and 6 officers is now in session. Tyros are converted into skilled divers in the short period of six months. Furthermore, these newly trained divers understand thoroughly the perils that they must encounter under the surface sooner or later, and they are taught just how to protect themselves when danger threatens.

The green divers of the U. S. Navy descend to depths of 150 to 200 feet or more in a tank only 12 feet high and 8 feet in diameter, containing some 8,000 gallons of water. By the use of compressed air, underwater conditions are simulated in this tank. Beginners master diving secrets in the tank without danger to life and limb such as they would experience if "learning their trade" in salt water. Such menaces as the octopus, deep-sea monsters and other marine menaces are eliminated from this training school program.

One former impediment was the extreme difficulty of breathing satisfactorily for long intervals at points far below the surface. Experiments with the diving chamber have resulted in the perfection of new combinations of synthetic atmosphere. Helium gas has been introduced most successfully in these mixtures. As a result, Chief Gunner W. F. Loughman has made a successful descent to a point 306 feet below the ocean surface—and remained there 20 minutes. In another test, this same diver performed important salvage work on a sunken ship at a depth of 265 feet.

In the experimental tank at Washington, one expert diver working under simulated sea conditions has attained a depth of 355 feet and has remained there for one-half a minute. This is the deepest dive ever made. The pressure to which this daring diver was exposed was stupendous—sufficient to crush to atoms some of the strongest buildings built by man.

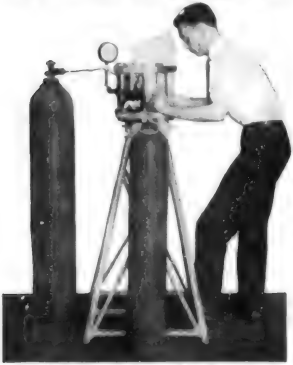
An additional atmosphere of pressure equivalent to 14.7 pounds per square inch



Not only does the diver withstand the terrors of a realm of ferocious marine creatures, but he must also subject his body to enormous pressure. At an average working depth a diver supports a weight equivalent to a column of the Woolworth building forty stories high and as large as his body section, or about 54,900 pounds.

Helium Gas Doubles the Hours that Diver Can Spend at Sea Bottom

developed in the diving tank by compressed air control exerts similar pressure on the diver as though he had descended another 33 feet. In raising the trainees to the surface of the tank after their experimental



A special compression chamber in which the reactions of mice are observed is used by experts in studying the effects of pressure on animals and human beings.

dives, care is exercised in gradually decreasing the pressure as where this is done hurriedly, caisson sickness is liable to develop.

If you are familiar with the precarious occupation of the professional diver, you have, unquestionably, heard about men who have suffered from "bends" or caisson sickness. The extreme pressures of deep sea diving, if reduced abruptly, leave bubbles of nitrogen in the blood vessels, tissues and body fluids. If these bubbles penetrate to the spinal cord or brain, death or paralysis generally results. The associates of the deep sea divers are extremely cautious in raising their mates from the vicinity of the ocean floor after deep descents.

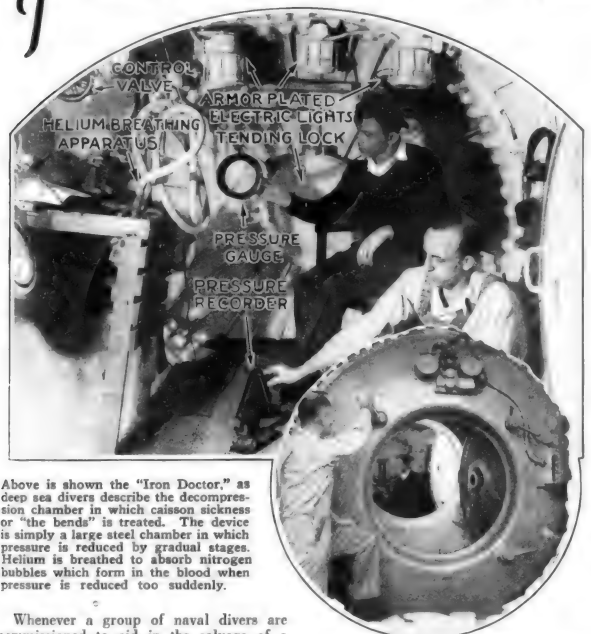
However, when the sea is rough and the waves are "bumpy," there is a liability that the diver may suffer severe ear injury or total loss of hearing. Helium gas is particularly important in such "decompression" for it is inert and absorbs the nitrogen bubbles readily.

Science has perfected the efficient decompression chamber known popularly as the "iron doctor" among the diving fraternity. This is a large cylinder of iron and steel with two compartments and various control doors and gauges in which the divers who suffer caisson sickness are treated in order to eliminate the nitrogen bubbles from their systems. Pressure is artificially applied within the tank to simulate the gradually diminishing pressure of a slow ascent to the surface.

During the era not so long ago when 200 foot dives were championship feats, the mill-run of divers customarily suffered nausea attacks in one dive out of ten. The provision of better equipment, the use of helium gas in the airlines and similar precautions have reduced this record to one case of illness in 50 dives. The experimental research and standardized training for naval divers fostered by Uncle Sam promises to further curtail this form of diving illness. Potentially, it may even be stamped permanently from the deep sea diving picture.

The U. S. Navy will train 62 men and officers annually for deep diving and subsequently will station them at strategic points along the coast. They will be ready constantly for emergency calls—to aid in the salvage of sunken ships and submarines and the succor of those endangered in such wrecks. They will also be available for routine underwater service at naval stations and in the repair and maintenance of our national fleet. Special boats used by these divers will be equipped with the all-important decompression chambers and other demonstrated accessories of comparable utility. The use of synthetic atmosphere in this decompression chamber reduces the treatment period from one-fourth to one-third over the time required where ordinary air is used. Furthermore, the use of helium gas in the diving airlines has practically doubled the time in which the divers can remain at work in the salt sea at perilous depths.

"Iron Doctor" is Used to Restore Divers to Normal Air Pressure

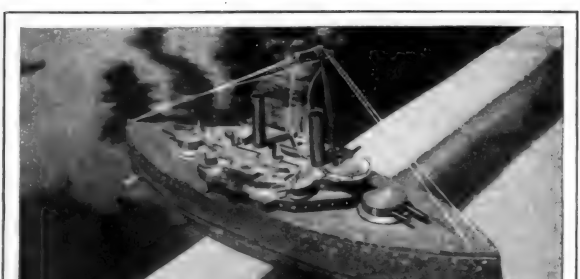


Above is shown the "Iron Doctor," as deep sea divers describe the decompression chamber in which caisson sickness or "the bends" is treated. The device is simply a large steel chamber in which pressure is reduced by gradual stages. Helium is breathed to absorb nitrogen bubbles which form in the blood when pressure is reduced too suddenly.

Whenever a group of naval divers are commissioned to aid in the salvage of a sunken ship, each man aspires to find and bring to the surface the signal bell of the waterlogged craft. It is the badge of honor —the coveted prize which proves the superiority of its discoverer over his mates. The rivalry is friendly and results in submarine sport and byplay which lends spice to arduous and hazardous labor at the bottom of the sea.

The diver must be expert in various repair activities such as the adjustment of marine machinery, electric torch work and related tasks. Even though skilled highly in such work, his efforts are hampered when buried under a blanket of salt water 150 to 200 feet deep so that his efficiency is only one-sixth of what it would be on land. The U. S. Navy through its remarkable instruction courses seeks to make the average diver more proficient than formerly and to educate him so that he will be qualified to make good in every emergency.

Five compressors whose individual capacity ranges from 50 to 75 cubic feet of air per minute are installed at the Washington Navy Yard.



Though not to scale, the model presents very pleasing proportions. Her great beam and stubbiness is a result of the need for carrying all the weight of the batteries and machinery, which are not scale weights. This view gives a very clear idea of how the completed model looks.

A WIRELESS CONTROLLED MODEL BATTLESHIP

by JOHN MURRAY

YOU model fans will find this a fascinating article. The writer tells how this simple hook-up controls every action of this model of the U. S. S. Pennsylvania!

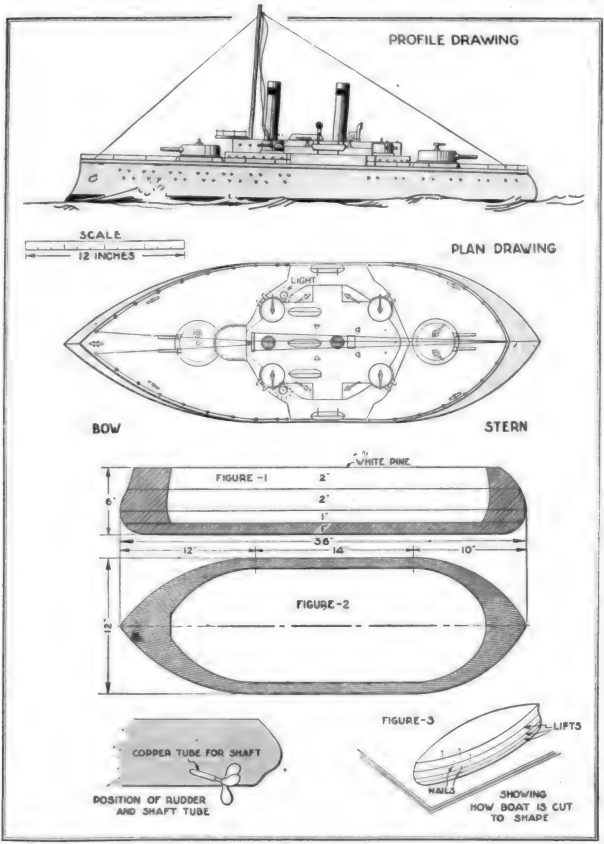
A BATTLESHIP model which will run for three hours and which will answer to almost anything wanted of it from ashore by means of a simple old-fashioned wireless transmitting coil, is a lot of fun. It is not hard to make, and I give the plans here showing just how to wire the hook-ups and how to build the boat.

The model about to be described will steer any direction and can be made to stop and start from a key on shore provided the boat is not more than three hundred feet from the sending station.

The method of operation is very simple and has the fewest working parts possible. On the boat there is a set of batteries which drives a motor to which the propeller shafts and a motor driven switch is attached. The secret of operation lies in the motor driven switch. It is like the switch on an electric sign, flashing the set of signal lights on and off. These signal lights are flashlight lamps set into the gun turrets and are flashed on at regular periods by the switch driven by the motor which drives the boat. The lights show what circuit is open. That is, if one light is glowing in the left turret and the boat is going along fine, it means that if the key ashore is pressed a wave will be sent to the aerial on the battleship, closing the circuit in the sensitive coherer (made from a druggist's bottle). This will operate a magnetic solenoid so as to steer the boat left.

The same thing happens whenever the key is pressed. If the forward light glows and the boat is running, the key pressing will send a single wave caused by an ordi-

How Hull is Cut for Model U. S. Battleship



This Model Battleship is Navigated from a Station Ashore!

John Murray with his model of the U. S. S. Pennsylvania, which is entirely controlled by radio.

Showing the deck removed for easy access to the machinery. The model is driven by the little gray electric motor.

The ground, of tinfoil, is placed alongside the wall of a pool just under the writer, who has the key in his lap. The boat is motionless, waiting for the proper signal to start her.

nary Ford auto coil into the coherer and make the solenoid on the boat shut the motor off.

When the light lights again as the wheels in the motor driven switch "coast," a press of the key will set the motor to running again and the boat will proceed big as life, and as though it had a "black gang" which was really doing the dirty work below decks.

If the right, or starboard, light is lit as the motor driven switch momentarily flashes it, and the key ashore is pressed, the boat turns right, or from right back to straight, depending on what it was doing previous to the pressing of the telegraph key ashore. Of course if the key is not pressed and the light goes out for a few minutes, the boat does what it was doing when the signal was ignored.

Much greater range could be had by fixing up a vacuum tube control to the relay, but heavy batteries would have to be carried, so I decided on simplicity. The "Pennsylvania" uses flashlight batts in multiple.

But we had better be building our boat. For this several white pine slabs two inches thick will have to be built. The hull is made on the "bread and butter" system, and like the views shown on page 141. First nail the boards together and with a drawknife the block can be roughly cut to shape in ten minutes. Then with a spoke shave it is cut closer to final form and the big nicks taken out of it. The lifts, as these layers are called, are marked so they can be put back into place after they have been taken apart and the inside sawed out with a key hole saw. This is shown in the diagram.

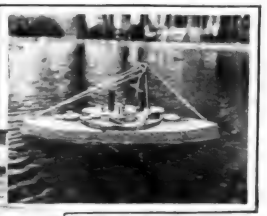
When the lifts have been sawed by saw as shown on page 141, they are set back into their place and are nailed together by inch-and-a-half wire brads about an inch-and-a-half apart. Before this is done there must be a mixture of bath tub enamel and white lead placed between the boards. Mix in proportions of one pint of enamel to a pound of good white lead. When the lead is mixed thoroughly, a half pound of ordinary whiting is stirred into the mixture along with a fourth pound of dryer. This will make it set quickly. The cement is applied to both planks on their adjoining surfaces, where they face each other. As the layers are registered into place and nailed the ooze from the seams ought to be wiped off.

When the hull of the boat has been assembled, it is set to dry and the top works is made. This is only a dummy layer of boards and turrets, and as long as it looks like the photos it will be realistic enough to

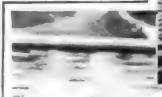
look right. After smoothing down with sandpaper the hull is painted with gray lead paint and has an orange stripe where the water would come.

The inside ought to be cleaned from saw "whiskers" and made ready for the power plant.

The motor which drives the boat operates on six volts. It ought to be large and direct current shunt wound for economical using of juice. The transmission can be made



The model sets well down in the water when at rest. The lights which signal the operator are in the turrets.



To the right the model is shown plowing her way along in great shape. The aerial can be plainly seen.

The model has a range of about three hundred feet when operating with the hook-up shown on page 146. Here a stop has been called at a range of about thirty feet.

from toy gears which are like I bought at a toy store. The motor is not geared down, only the shafts are made to run opposite directions so that the boat won't turn more in one direction than in another. Off the transmission the motor switch is driven. The drawings show the hook-up.

Next the hull is bored for the propeller shafts, which are nothing but hard wire about $\frac{3}{32}$ inches thick and which are run through copper tubes.

When the motor bed is placed and the holes for the shaft drilled and the shaft tubes in, the motor and the transmission are lined up. As there will be considerable jerking while this is being done, it is a good thing to screw the boat to the workbench with a hole through the bottom. They are to be plugged with cement when the work is done with.

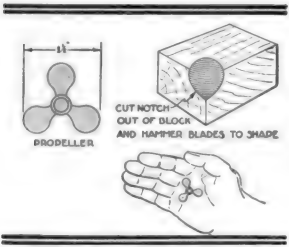
A two-to-one reduction on the propeller shafts would add to efficiency if you care to figure out your own drive. The propellers are home made from brass. Turn the bosses out and fit them to the propeller shaft, then saw slots with hacksaw blade and solder in the blades. The right diameter for a six-volt motor on a two-to-one reduction is one and a quarter inches for two propellers and a thirty-six inch hull like this one.

That is the driving plant. The battery, made from flashlight cells with wiring soldered on, is put into place and paraffine poured around them to make them water tight. Some water is bound to seep on to the hull insides. The batteries are wired as shown to run to the different switches.

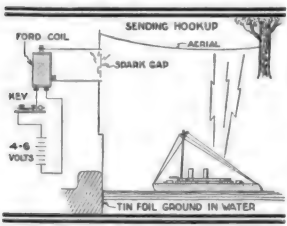
Then the controlling machinery is made.

The heart of the receiver is the coherer, which is connected direct between the aerial and the ground on the boat (which is a plate of tin on the bottom). This is all there is to the wireless receiving circuit on the boat.

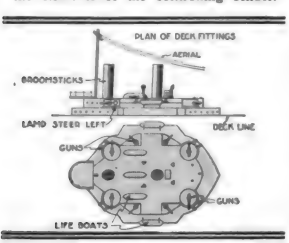
There is no coil or detector or anything but just the coherer and the aerial and the ground. The coherer in this case is a small druggist's vial filled with half and half nickel and silver filings between two silver plugs set in the ends of the vial. The dis-



The propeller blades are hammered in a wooden die and soldered to a brass hub.



A Ford spark coil, a key and a battery are the elements of the controlling sender.



The lamps which register the position of the motor driven switch are located as shown, in the port and starboard turrets. The deck is made up of layers of wood as shown here in diagram.

tance between the plugs is about half an inch. Across the coherer is connected a relay.

The coherer is a non-conductor until a wireless impulse is sent through it. Then at the faint current the iron and nickel or nickel and silver line up like polarized molecules in a magnet and form a circuit through which the current for the relay can throw itself.

The battery to run the relay is a two-to-four volt affair made from flashlight cells and the relay can be home made as shown. The relay turns the power from the six-volt battery into the control switch and makes connection for whatever control switch is in position for. A decoherer is made from a buzzer, which depolarizes the coherer by gently rapping it for a second after the impulse has closed the relay. Once the relay is set it will stay that way till a fresh impulse swings it back. The relay will have to be delicate to swing either way and not stick. The one in the drawing will be good if adjusted close.

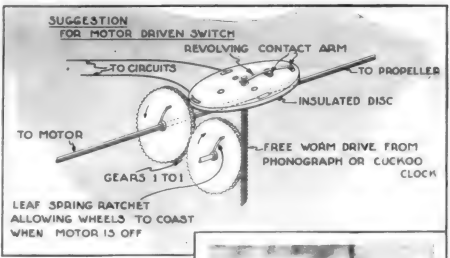
Then the control switch is made and connected. The one I made I have sketched here. It works. The big idea is to get the connections to pan out the right way so that when the current is shot through the right thing will happen. The control will have to be geared down to turn pretty slow. I found that while a fast turning control will give you better chances of quickly handling the boat when it is out, there is a lot of lag in reading the signal and deciding just what you want it to do—whether to press the key and alter it or to let it keep on going. There is only one way to do it and that is to cut the gear ratio till you get what is right.

The boat is steered by a rudder hooked to a spring solenoid of No. 30 wire. The rudder rod is one-eighth inch mild steel rod running in a copper tube with a solder stuffing box. It has a beam or yoke on top with a spring on one side and a Norwauy iron core on the other.

The control lights are three in number and are put into the gun turrets or port lights. The port lights on my boat were made from shoe eyes hammered into the hull after a row of holes was bored. It is better to put them into the turrets so you can see which one is flashing.

All of the connections should be spliced for a good ways and taped, or better yet they ought to be beaded with a solder drop. The model can be tried out at home, so as to run better when in the water. It can be placed on a table and the sending set may be put any place.

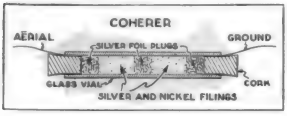
The sending set is only a spark coil connected to a set of batteries by a key or a switch. A key is better because a circuit can be made quickly. A spark gap is made from nails, and the ground is hooked to one side of it, and a length of wire to the other. The latter forms a sending aerial. I found that a piece of tin foil, dipped right into the water, made a better ground and increased the radius of control. It can be seen in the pictures. I am sitting over it as the boat is running about in evolutions.



The heart of the control system advocated by Mr. Murray is a motor driven switch which will serve as a master contacter for all the circuits in the boat. It is his suggestion, shown here, that the switch be so constructed that it will coast for a reasonable period of time after the main driving motor has been shut off by an impulse from shore. To the right is a view of the machinery.

If a Ford spark coil is too weak to give a good spark a bigger battery can be used or a bigger coil. The idea is the bigger the spark across the gap the bigger the impulse and the more range of operation.

There are several sources to which you may look for various parts of the system. For instance, the coherer might be taken from an old railroad telegraph set. These always have coherers on the relays, and as they are equipped with decoherers the equipment might be installed complete after an extremely sensitive adjustment had been secured. Then, too, those of Modern Mechanics readers who are radio fans can design their own receiving sets. A one tube receiver could be made which would operate up to a radius of one mile and better, using nothing better than the Ford coil and gap sender.

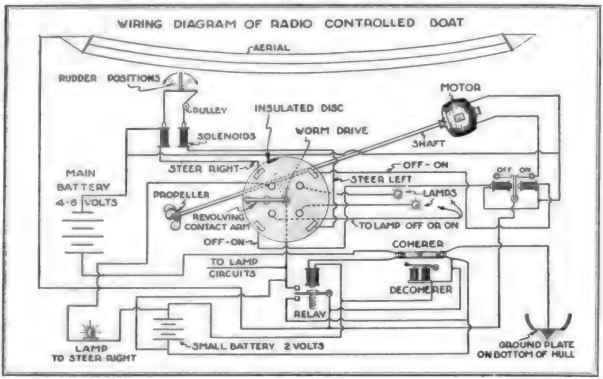


Of course, should you desire to increase the range, it would be well to increase the battery capacity so that you would be sure of having the model return.

That is all. I hope you have as much fun fussing with your own model as I did with mine. There is nothing difficult about it at all and the problems test one's ingenuity.

Possibly, to save weight, you might want to use a mechanical motor in place of the heavy electrical drive.

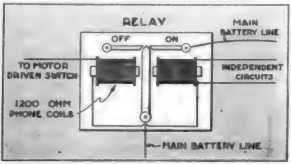
This Wiring Diagram is Simple to Hook Up for Wireless Control



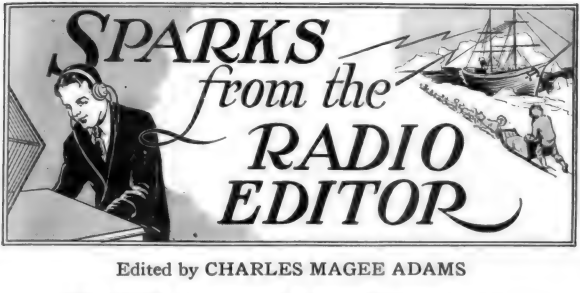
There are several ways in which the ship may be wired to secure a variety of controlling actions. About the simplest is indicated here. The small battery may be a flashlight cell.

In this case you can use the motor off an old phonograph and rig an electromagnetic solenoid brake on the governor. Don't strip the motor of any of its gears. Just lay it so that an adapter gear can be taken off one of the spindles so as to drive the propeller shafts. The motor can be wound through the deck. The range is, of course, limited with mechanical drive.

Start to make your boat now so that you will have it completed and ready for launching when the spring months roll around. You will then have ample time in which to iron out any wrinkles which may have crept into your design. A few trial cruises in a bathtub will give you a good notion of the performance possibilities of your craft, although a dry-land method of testing, involving the mounting of the model on a pedestal where the machinery may be observed in action, is also satisfactory.



NEXT MONTH watch for T. S. Asgaard's article on how to build a magic lantern. As with all of Mr. Asgaard's excellent designs, the magic lantern can easily be built in the home workshop from inexpensive materials. Watch for the March Modern Mechanics, out February 1.



Edited by CHARLES MAGEE ADAMS

THE KARAS three tube set is an ideal set for short wave receiving. Charles Magee Adams here tells how to assemble this remarkable radio receiver so that programs from all over the world may be received. Distances which no ordinary set could tune in on can be picked by the Karas set with ease, and those who wish can listen in on WFBT, Commander Byrd's South Polar base ship!

With This Set You Can Listen In On Byrd!

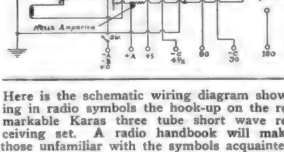
THE short waves—from 200 meters down—have rightly been called the "thrill band" of the radio spectrum, because distances not possible at broadcasting wave lengths can be covered with such marvelous ease. Everyone agrees that there is a real and considerable kick in hearing Australia or South Africa. But this is a humdrum affair compared with the thrill which awaits those fans who, during the next two dozen months, will pick up the dots and dashes of the Byrd expedition as they wing their way from the bottom of the world.

Using nine short wave channels (91.3, 68.1, 53.1, 45.6, 34.06, 26.5, 22.08, 17.95, and 13.72 meters), 20 transmitters and 26 receivers, Commander Byrd expects to maintain direct communication with the United States at all times, depending primarily on the special 1,500-watt transmitter, WFBT, aboard the supply ship City of New York. The greater part of the work probably will be done on the three channels of 45.6, 34.06, and 22.08 meters.

The question, then, for the thousands who wished to go with Commander Byrd but who were compelled to stay at home is how to build a set that can be expected to bring in the thrilling dots and dashes of WFBT. This is not difficult.

The efficient short wave receiver illustrated employs only three tubes—a regenerative detector and two stages of audio amplification. But it has several features which are different from the ordinary broadcast set using a similar basic circuit.

First, it will be noted that there are three sets of interchangeable secondary and tickler coils. These interchangeable coils are necessary if the band from 15 to 130 meters



Here is the schematic wiring diagram showing in radio symbols the hook-up on the remarkable Karas three tube short wave receiving set. A radio handbook will make those unfamiliar with the symbols acquainted with the various elements.

is to be covered efficiently. The largest is to be used for 57 to 133 meters, the intermediate from 31.5 to 68 meters, and the smallest from 15 to 33.5 meters. By means of a plug-in arrangement the one suited to the channel being worked can easily be inserted in the circuit.

All these coils and the two straight line frequency condensers are of the low-loss type, a feature of special importance in short wave work. Also, the layout has been planned to avoid losses due to what is known as absorption. In a short wave receiver this causes "dead spots," points around the dial at which the set cannot be made to oscillate and hence is insensitive.

The arrangement of parts is taken care of automatically, since both the panel and sub-panel come drilled. All that need be done is to slip the indicated parts into the indicated holes. This is the first step in the construction. After it has been done the wiring can proceed.

If good tone quality and large volume are desired, as for the operation of a loud speaker, the tubes indicated should be used —a 201A as detector, a 112A as first audio, and a 171A as last audio. A total of 180 volts of B battery will then be required, and an output filter or transformer should be connected between the speaker and the receiver.

However, if only head phones are to be used, three 201A tubes will give good results, requiring only 90 volts of B battery. In either case a 6-volt storage battery will be needed for their filament supply.

To place the receiver in operation, insert one of the plug-in coils, turn up the rheostat till the filaments come to normal brilliance, then rotate the right-hand dial counterclockwise. A soft click or "plop" should be heard. This denotes that the receiver is in oscillation. Now rotate the left-hand or tuning dial slowly from 0 to 100. If a station is within range a whistle will be heard. To bring it in clearly, adjust the right-hand dial to the point where it comes in loudest, further adjusting the rheostat if necessary.

It may be that no station is within range on the particular band covered by the coil used. In this case, substitute another coil and repeat the test.

Do not expect the two dials to show the same readings, as in the case of a two-dial radio frequency receiver. Only the left-hand dial tunes the set, while the right controls the amount of regeneration. A station will come in at approximately a given reading on the left-hand dial, but the adjustment of the right will vary according to conditions.

A good ground, of course, must be provided, and an efficient aerial. There is a notion to the effect that any sort of a makeshift aerial will do for short waves. But this is very much not the case. The overhead wire must be as clear of surrounding objects and as well insulated as for a broadcast receiver, if real distance is to be obtained.

However, even a good aerial may sometimes show "dead spots" on short wave work, due to what is known as harmonics. If these dead spots develop (and the receiver has been properly wired) adjust the hinged primary; and should this not correct the trouble, connect either a small fixed condenser or a loading coil in series with the antennae and the set.

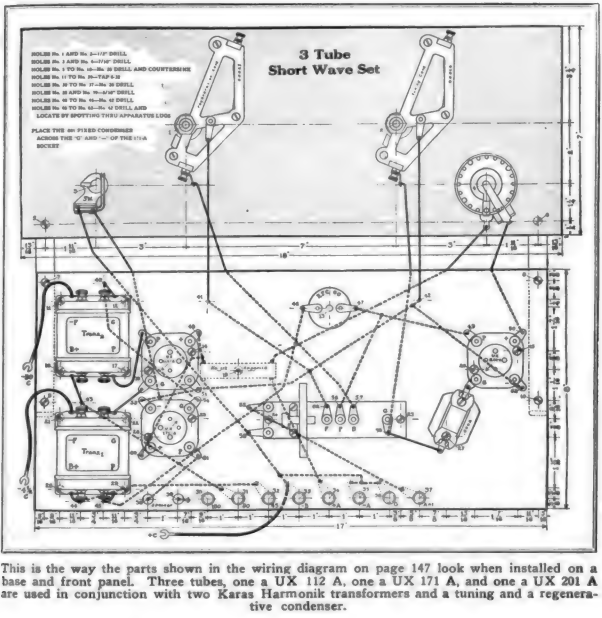
With the receiver working smoothly and

$60 IS COST OF PARTS FOR BYRD SET

The parts required for the receiver are as follows:

Two Karas micrometric dials, 0-100.
One Karas .00025 mfd. variable condenser.
One Karas .00014 mfd. variable condenser.
One set Karas sub-panel brackets.
Two Karas Harmonik transformers.
One short wave coil system.
One 60 millihenry r. f. choke.
One 20-ohm rheostat.
One No. 10 filament switch.
Two phone tip jacks.
Three sockets.
One No. 112 amperite unit.
One 4 megohm grid leak.
Eight X-L binding posts (9/32).
One bakelite panel, drilled, 7 by 3/16 inches.
One bakelite sub-panel, drilled 8 by 17 by 3/16 inches.
One .0002 fixed condenser with clips.
One .001 fixed condenser.
One lot miscellaneous soldering lugs, screws, spade terminals, wire, and sleeving.

These parts can be purchased as a complete kit known as the Karas "Round-The-World" short wave receiver. They are sold by the Karas Electric Company, 4081 Rockwell St., Chicago, Ill.



This is the way the parts shown in the wiring diagram on page 147 look when installed on a base and front panel. Three tubes, one a UX 112 A, one a UX 171 A, and one a UX 201 A are used in conjunction with two Karas Harmonik transformers and a tuning and a regenerative condenser.

the knack of tuning cultivated, the fan can look forward to many pleasant days and nights cruising the air for the thrilling dots and dashes of Commander Byrd's big 1,500-watt transmitter. Of course the messages will come through in Continental Morse Code. But for those fans who do not know this code, there are also many hours of pleasure listening to program broadcasts from distant American and European stations while they acquire sufficient familiarity with the dots and dashes of the code system to read what comes up from the bottom of the earth.

WHO can predict the future of radio? On page 140 of this issue are plans for a model battleship controlled by wireless. "Treasure Hunters," on page 88, tells how radio is used in locating buried gold! Will gold mines of the future be located by electricity, and naval battles be fought from the shore? Read these fascinating articles!

VENT SAVES *Bank Vault* PRISONERS

SLOW death from asphyxiation is the horrible fate to which bank employees have been doomed when, either through the command of hold-up men or through accident, they are forced into an airtight bank vault where a time lock keeps them imprisoned for hours. A device which insures a constant supply of fresh air under these circumstances has been perfected by Carl W. Olson, shown above.

"STICK 'EM UP!"

"Now waltz into the vault!"

These commands, ripped out to hapless bank employees as they look into the muzzles of awesome revolvers, will no longer hold the old-time terror.

For to be locked in a vault equipped with the new ventilation device invented by Carl W. Olson, president of the Olson Utility Equipment Corporation of Minneapolis, will not mean danger of lingering death before the time lock can be opened.

Mr. Olson's device, which can be set into operation from inside the vault in a few seconds, will insure enough live air being drawn inside and sufficient carbon dioxide to be expelled to permit a dozen persons to live in the steel prison for 24 hours without feeling any ill effects.

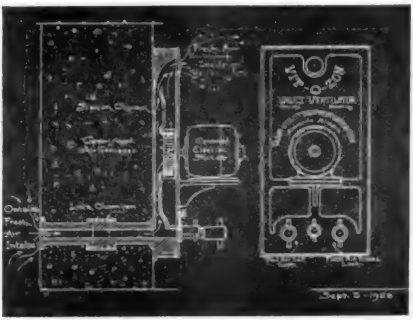
Mr. Olson, who was for four years patent engineer in the Swedish patent office at Stockholm, but who for the past fifteen years has been engaged in perfecting bank protection and burglary-proof vault devices in Minneapolis, has solved the problem of devising a practical and efficient ventilation system without lessening the burglar proof or fireproof qualities of vaults, or increasing the insurance rate.

Two 1½-inch channels are made through the vault wall and into them are inserted rods or plugs of steel which seal them hermetically, but which may be removed from

Ingenious Machine Supplies Fresh Air to Bank Employees Imprisoned in Air-Tight Vaults.

If locked inside a vault equipped with the Vit-O-Zon ventilator shown above, the prisoner can set the device in operation and be assured a supply of fresh air.

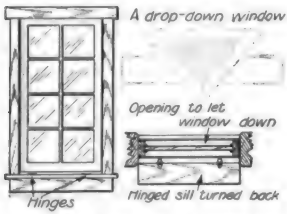
the interior by a slight twist of the connecting levers which automatically set in motion a Zirocco type motor with a special siphonic attachment which draws in pure air from the outside through one opening and expels the impure air through the other. The rods are so firmly held in place by a special locking device when the ventilator is not in use, that they cannot be driven or twisted out of position from the exterior.



The above blue print shows how the device operates.

Miscellaneous Kinks

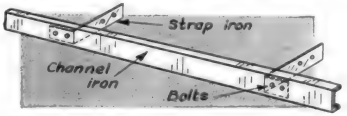
DROP-DOWN STREETCAR WINDOWS FOR THE HOME



HERE is the way in which one home-builder solved the problem of how to put in porch windows so as to be able to open the entire space when desired. He utilizes the street car window idea.

A sill the length of the window opening was hinged to the inside of the frame as shown in the drawing. When the window is closed, it rests on this hinged sill. When it is to be opened, it is shoved up far enough to allow of the sill being turned up out of the way, then the sash is lowered into the space below, and the sill is closed over it.

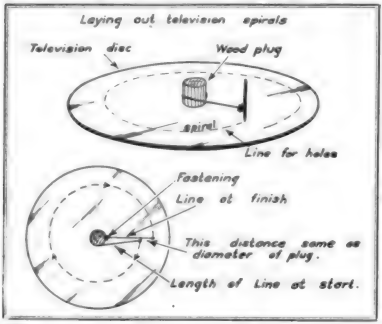
PIECE FROM CAR FRAME MAKES GOOD BUMPER



TO MAKE an efficient automobile bumper, cut a section from the side frame of a discarded car and bolt it to two pieces of strap iron as shown in the diagram. It is a simple matter to bolt the bumper to the front of your automobile, where it performs satisfactorily in protecting the machine from collisions.

METHOD OF LAYING OUT TELEVISION SPIRALS

HOW can I draw a spiral? That is a question many a radio fan is asking himself these days as the building of simple television sets becomes more popular. An easy method is the one pictured in the diagram printed below.

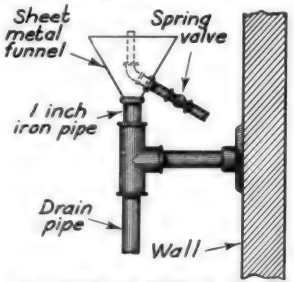


Take your disc, center it, bore your center hole, and fasten a plug in the center with a screw. This plug has the same diameter as the lag or pitch of the spiral you want. Mark where you want the largest diameter of the spiral to occur. Then fasten a tack on the wood plug opposite this point. Wind a string from the outside point around the plug. Stop at the inside point, fasten a pencil to the string, and keeping it taut and on the disc unroll it. The result will be an accurate spiral which you can bore for the scanning lenses.

for the HANDY MAN

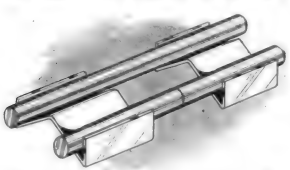
A BUBBLE FOUNTAIN FOR THE HOME SHOP

A BUBBLE fountain for use in shop, garage, or basement is easily constructed. An ordinary sheet metal funnel which, when the neck is cut off, will just slide onto a piece of one-inch iron pipe, is secured and the neck removed by file or snips. A half-inch hole is made in the funnel near the small end and the funnel fixed securely on a one-inch nipple by a locknut on one side of the large drain hole and solder on the other, as the sketch indicates. The nipple is screwed into a tee as shown, and the tee is mounted on the wall or post by means of a pipe flange and long nipple. The open end of the tee is arranged for a drain. A length of quarter-inch galvanized pipe is screwed into a 45-degree elbow and the two mounted, pipe upwards, in the funnel by means of another piece of pipe and two locknuts. A spring valve which closes when released is fitted to the outside end of the slanting pipe and connected with the supply main.



V-BLOCKS AID IN WELDING

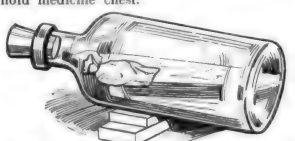
A SIMPLE and inexpensive piece of equipment which makes it possible to hold pipes or tubes in perfect alignment while welding them can be made from a piece of flat metal stock about ¼-inch thick. Bend it to the double V-shape shown in the diagram and cut it in two; in this way both pieces are bent to the same angle. The piece to be welded is



laid in one of the troughs, a solid rod first being placed in the other V to hold the device in perfect alignment while the work is being done.

SEIDLITZ POWDER CANNON

STORMY days which confine the children to the house are often the bane of the housewife, who is at a loss to find new ways to keep the kiddies' active minds absorbed in play. This seidlitz powder cannon is a harmless and amusing toy which can be made with an ordinary bottle, with water, and the supply of seidlitz powders usually found in every household medicine chest.

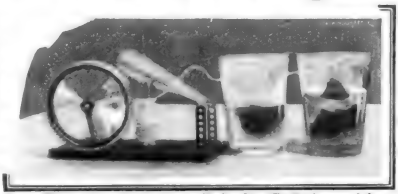


The powders are separated into smaller portions than are usually dissolved, and are wrapped with tissue paper. A string is tied around this "cartridge," and it is dropped part way into a partially filled bottle of water. Then the bottle is corked.

When the bottle is lowered on one side, so that the water reaches the powder but does not quite come to the mouth of the bottle, the powders will fuse to form a gas which will drive the cork from the bottle with a thunderous retort. The toy is harmless.

SIMPLE PLANS for Electric CLOTHESPIN Engine

THIS electric engine can be built in an hour by anyone and will make a fine toy. It is built of an old wheel such as an old light sewing machine wheel for a flywheel, a clothespin for a walking beam, and a few pieces of sheet metal. The wire used can be bought for a nickel at any radio store. It is No. 30 cotton covered.

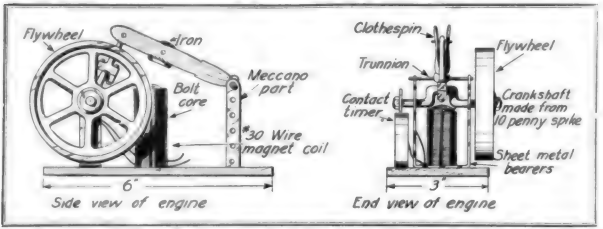


The clothespin engine built by Mr. T. S. Asgaard is shown running on some home-made wet batteries.

The base of the engine is three inches by six. The engine I made shown in the pictures had a base of fir this size, and a quarter inch thick. The bearers for the bent wire crank are cut from sheet metal as in the drawings, and are hammered to the base with heavy tacks such as are used by shipping clerks when they attach labels.

When the flywheel has been put in and made to run free, the crank is made and fastened to the walking beam. The walking beam which carries the piece of soft iron for use as an armature goes into this crank with a nail as shown. The head end of the clothespin is split part way with a knife and the piece of zinc used as a head anchor pin is put in. You will find that the clothespin, being of birch, is tough and will hold the bent over piece of zinc nicely. Use the ten penny wire in ten penny nails for the main pin and also for the crank. The engine is set up as shown in the drawings.

The magnet is made of a good grade of fine copper wire. No. 30 is best and should be cotton covered. About a hundred feet is enough. It is wound around and around the soft iron bolt which goes through the base, and a piece of newspaper should be put around the core. The magnetism will be much better. The magnet is wired as shown. One lead is direct from the battery.



The simplicity of this engine is apparent at first glance. There are but a few elements and they are easy to make. A flywheel from a little old sewing machine, a few Meccano parts and a coil of wire are all that are needed for the building of this little old chug-chug. Can you design a simpler one? See details of the contest on the opposite page!

the other goes to the timer, which shuts the circuit on and off at the right time, so that as the iron core held in the pin is about to descend the current is turned on and the core is drawn toward the magnet. The current is shut off at the bottom of the stroke and the flywheel keeps on coasting, so the process is done again.

The wire for the crank is made from a ten penny nail and is bent with pliers over a gas flame in the kitchen when it is red hot and will bend easy. Meccano parts can be used for the trunnions for the head anchor pin.

When the engine is assembled a simple battery can be made for it by taking coke and strips of metallic zinc and binding them together with adhesive tape. Run copper wire from coke to zinc and coke to zinc. This is the same as positive to negative. Put them in a jar apiece and cover halfway with a solution of zinc chloride or sal ammoniac as it is known to drugstore keepers. About a volt a cell will be their output, so you will need six cells at least to make this clothespin engine run.

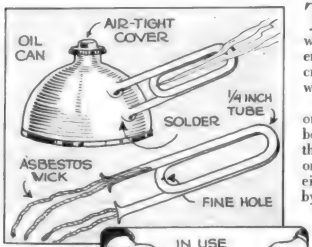
When you wire the timer, run one wire from the magnet to the engine bearer. This will make a connection with the crank shaft and with the cam on the end of the crankshaft and will let the current run from the cam to the contact piece, which is of zinc or copper. It is best not to have it too springy or the engine will have to be started by giving the flywheel a coast with the hand.

A smoother running engine can be made by using a whittled piece of wood instead of the clothespin, letting it run over the anchor pin at the trunnions, and balancing it like a teeter-totter. The engine shown in the drawings will run nicely but will not run very fast, because it is not in balance. It will run at a 1,000 revolutions per minute. An engine with a balanced walking beam would run a few hundred revolutions faster.

Well, that is about all there is to it. This walking beam electric engine is very easy to make and will not cost much. If just the right combination of flywheel and magnet is got, a very fine engine will result. If you have trouble in getting a flywheel, paper patterns moulded in plaster paris will cast a good one in lead.

The more turns of magnet wire you get on the magnet and the bigger current you use, the more the power of the engine will amount to. Good splicing of wire is very important.

OIL CAN MAKES GOOD BLOWTORCH



For emergency use, this oil can blowtorch will be satisfactory.

THE HOME workshop fan often finds himself without a blowtorch, without which he is at a loss to do those little emergency jobs of soldering which always crop up at the last moment while playing with experiments.

A very serviceable little substitute for the ordinary gasoline pressure blowtorch can be made from an old copper oil can. Take the bottom, or bowl portion, and drill two one-eighth-inch holes into which a loop of eighth-inch copper tube is bent, as shown by the drawing.

Solder the tube into the can. The tube has previously had a wick of asbestos packed into it. The ends are permitted to dangle in the bowl of the torch. A pin hole is bored into the bottom of the loop.

Gasoline is placed in the can and the top put on tightly. A match held to the loop will vaporize the gas.

Complete Details of Wall ENGINE CARBURETOR

By ELMER WALL

Shown here almost two-thirds full size, this little carburetor supplies the atomized gasoline charge to the Wall Model Aluminum Gas engine shown below.

LAST month in MODERN MECHANICS the writer dwelt at length upon the details of constructing the major parts of the Wall air-cooled model gas engine. He has been asked by the Editors to here say that there are no copies of January available and it is further urged that in order to be sure of receiving full details of the various designs published in this series the reader arrange to have his newsdealer supply him monthly with copies of the magazine. The editors cannot send back copies of the magazine. There are none available.

In January the plans for the cylinder and the working parts of the motor were given, together with all dimensions and instructions for working them up in the lathe. The plans herewith are the plans for the carburetor, or "lungs" of the motor which were mentioned last month. The casting for the carburetor bowl is made of aluminum. The bowl is cored out, but the intake is not. It is drilled after being cast.

The slanting lug for the needle valve is put on a line as shown by the drawings with the float receiving boss on the bottom of the bowl.

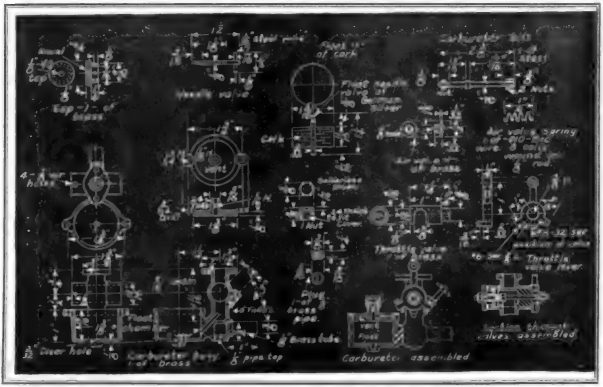
This allows the casting to be held in line so that the hole for the needle valve can be easily drilled.

The cover for the bowl is cast as a solid flat piece. The pattern is perfectly simple and can readily be understood by any one. If it is desired complete castings may be bought from the author at 5900 N. Fairfield Ave., Chicago. These come in form ready for machining. The bowl top is chucked in the lathe in the ordinary way turned and faced, and then the rough edges cleaned up with a file, after which the small hold down bolt holes are drilled.

The float itself is simple. It is of cork with an inverted needle valve of German silver. The German silver can be had from most any German drawing instrument. Its only disadvantage lies in the standpoint of cost, for this will amount to two or three dollars. The desired qualities of hardness and smoothness, a requisite of any needle valve, will not be found in any other metal, however.

Described in the January issue of Modern Mechanics, Mr. Wall's fine model gas engine is shown here with carburetor in place. Note throttle valve placing.

Simple Aluminum Casting Makes Carburetor Bowl and Throttle Parts



Full details for the building of the carburetor for Mr. Wall's engine are contained in this blueprint which gives all dimensions and specifications necessary. Note that the needle valve on the float is of German silver because of the smoothness which it will give to the needle point. Construction of the very clever combined choke and throttle is shown in the cross section view in the lower right hand corner.

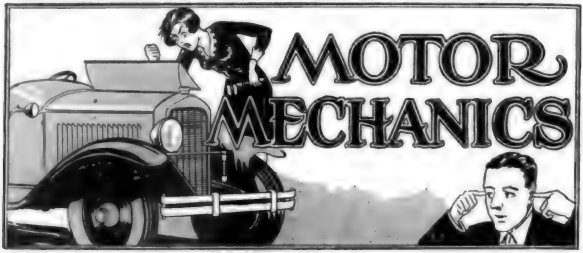
The cork can be bought in block form from any supply house, and should be of the highest quality of close grained hard cork. If it is the ordinary open grained kind such as is found in cork blocks in boat life preservers for instance, it will not do. There can be no shellac get to the inside parts and the gasoline will quickly log it, causing uneven adjustment and extreme hard starting of the motor. Make the block as solid as you can. Cork can be turned very well on the lathe, using a file for the cutter.

The main needle valve is made of nickel steel which is hardened and ground to a sharp concentric point after the machining and screw cutting has been done.

In starting the motor and in obtaining the proper setting of the carburetor, the following procedure should be resorted to. Of course, with a green motor which has never been run and with a carburetor which has never before gasified a liquid fuel, nothing but empirical experiment can be resorted to. See that there is plenty of good high test gas in the carburetor bowl and that the gravity feed is not too high. The little cork float will be loaded fairly heavy with the needle valve and cannot float against a great deal of pressure. When the feed has been adjusted and the bowl is flooded, open the valve on the feed about three-quarters of a turn. Pour a little cylinder oil into the cylinder, say a teaspoonful and turn the engine over a few times.

If the mixture is too rich the exhaust will grow weak and the smoke will be black and oily. Screw down the carburetor and choke it until the motor catches on. If it will not run as soon as the choke is released, there is not enough gas.

It is a case of experimenting all the way through.



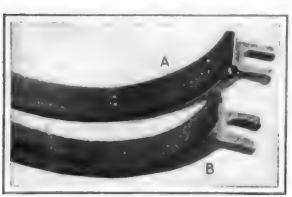
Conducted by RAY F. KUNS

AS DIRECTOR of the Automotive Trade School of Cincinnati, Ohio, Mr. Kuns has for many years been one of the most prominent figures in the automotive world. Each month in this department he gives his expert advice on the proper care of your automobile.

Skillful Driving Preserves Model T Ford Bands

FORD Model T bands are designed to operate in a bath of oil. The band linings are porous strips of cotton material especially woven and prepared for the work of clutching the drums for low speed and reverse, and also for use in braking the car.

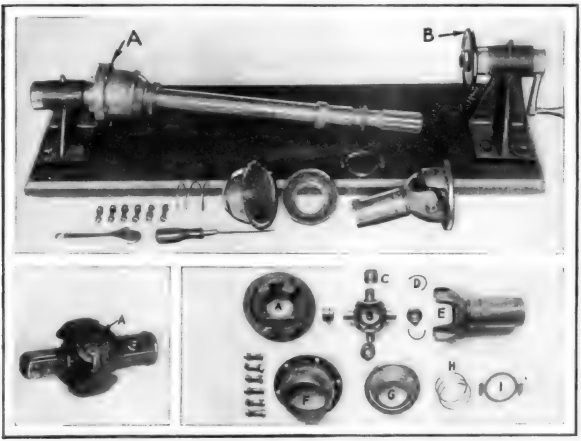
When the car is being driven along the roadway in high gear there is a constant bath of engine oil falling onto the bands and this finds its way into the fabric of the band linings, completely soaking them. In descending a long hill, the brake pedal is sometimes held down tightly for long periods. Holding the brake down steadily will result in burning the band lining and glazing it as shown in section B of the photograph. A portion of the glaze has been picked off with a knife. It looks just like charcoal. A band lining in this condition is useless.



The driver may put a band lining "out of commission" on a single hill. Or a good driver may preserve the bands in good condition indefinitely as may be witnessed by looking at the band at A in the figure. This band has seen thousands of miles of service over the same hills which proved the death of the band at B. Note that every thread of the fabric stands out on this band. "What is the secret?" you ask.

It is very simple in operation and principle. In the first place, release the foot brake every little distance in descending a long hill. This allows more oil to find its way into the lining to saturate it, cool it, and keep it fit. If the hill is long use reverse in conjunction with the brake. While one band is cooling and being lubricated the other checks the car.

How to Remove and Repair Noisy Universal Joints



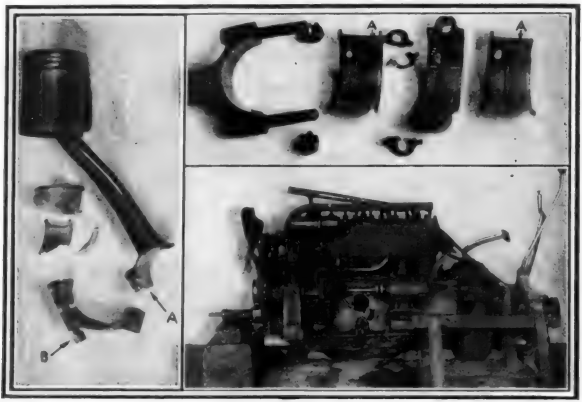
UNIVERSALS are used to connect the transmission shaft with the propeller shaft. If the propeller shaft is enclosed one universal is used on it, if exposed two are used. Wear occurs within the universal if it is not properly lubricated or if it is over loaded. At A in the lower corner of the above photograph, wear of a very serious nature is indicated. This Ford universal was not lubricated. Possibly the grease cup provided was never given a turn. Is it any wonder that the owner complained of noise and of back-lash?

The first thing to be remembered is the lubrication, since it is doubtful if there is another unit on the car which has to work under harder conditions and very often with little attention.

The method of pulling a propeller shaft of the exposed type is illustrated in the picture of the model shaft in the upper picture. The shaft, except for length, is identical with those used in many passenger cars. To remove the shaft first remove the bolts at A and B. The joints come away and leave the flanges on the transmission shaft and on the pinion shaft. The propeller with the joints on it may be taken to the bench for repairs. When disassembling one of these joints the part I is removed and the spring H follows. Next the grease retaining cup G and then the housing cup F. The joint is then exposed and it will be necessary to pull the two wires D and then the steel bushings C will come off of the cross B and allow the yoke to be pulled from the body A.

The cross and the cross bushings require replacement in this type of universal. In fact, that is the most usual fault with any universal of the metal type. Removing the play from the universal, by removing worn parts and replacing them with new, will take out much of the disagreeable back lash between the engine and the rear axle.

What Happens When a Connecting Rod Lets Go



WHEN an engine connecting rod lets go, something just naturally has to happen. In the instance pictured above, the rod knocked a hole through the engine wall and caused a tidy repair bill. At the left above is shown what happened to the rod. A broken rod bolt is indicated at A, while B shows a nut loose due to lack of a cotter key. The upper panel shows another rod from the same engine with the babbitt metal broken out at points A A due to maladjustment.

COLD WEATHER DRIVING HINTS

1. Use light oil, it flows more freely.

2. Keep the chains in the tool box or on the tires.

3. Test the gravity of the battery frequently.

4. Do not fill the radiator to the top with antifreeze. Leave two or three inches for expansion.

5. Do not scald yourself by removing the radiator cap from a steaming car.

6. Drain the crank case each 500 miles.

7. Try cranking by hand if you think your car may be frozen.

8. If the battery is "weak" remove it and give it a bench charge.

9. Choke the engine when stopping it for the night.

10. Chains on four wheels go well with four wheel brakes.

11. Test your engine oil by setting a bit outside on a cold night.

12. Do not run your car in a closed garage. Carbon Monoxide Gas kills without warning.

13. Do not neglect the tire pressure just because the weather is cold.

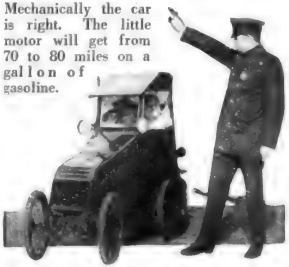
14. A car heater costs little and affords much comfort.

15. Snug exhaust pipe connections prevent exhaust gases getting into the driving compartment.

World's Smallest Auto Demands Traffic Equality

TRAFFIC regulations have made no qualifications concerning the size of a car. Here is the world's smallest car taking the right of way in Brooklyn, N. Y. Officer Thomas Hallman was rather surprised when Master Bernard Muller and his playmate, Miss Adele Wallack, rolled up to the corner. An approaching street car was far the biggest but the tiny car had the right of way, so the officer held up traffic for it.

This miniature automobile was built by Isidor Lubin of Brooklyn. Mr. Lubin is a mechanic by trade and used old parts for the major portion of this car. The actual size of the car can be gathered from its measurements. It is 28 inches wide, 58 inches long and 36 inches high. Mechanically the car is right. The little motor will get from 70 to 80 miles on a gallon of gasoline.



These youthful autoists are enjoying an afternoon's airing. Officer Hallman, of Brooklyn, gives them the right of way.

A PERFECT RACING MODEL

GREAT BRITAIN'S speed king, Captain Malcolm Campbell, is seen here giving his son Donald a few hints on driving. Donald's car is a perfect model of a Bugatti racing car. It is electrically driven, goes 18 m. p. h. and cost $300.

This racer can go 18 m. p. h.

NEW DIESEL FUEL

TWO French engineers, Henri Marcelet and Georges Lumet, recently found that a Diesel engine will operate on a new fuel, fish oil. Experiments were conducted by these men to obtain the relative value of this oil as a Diesel fuel. It was found that the heat value of fish oil was only slightly less than that of mineral oil.

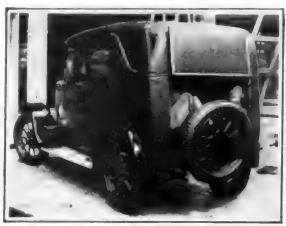
As so many times happens, the experiment proved that the process of combustion killed any fishy odor that might have existed.

NEW TRUNK RACK FOR SEDAN

AMONG the models seen in the great automobile show at Olympia, England, was a Jowett fabric sedan. This car, as seen in the photo below, is completely covered with Jowett fabric.

Instead of equipping the car with a trunk rack and trunk, the luggage space was built within the body. The panel, in the back of the body, lifts out and upward on hinges. The opening thus exposed is large enough to hold a man and not unnecessarily crowd him.

The English motor car indicates the trend of European design.



CONQUEST of the

Attacked by the ferocious Va-gas, half-human horse-men of the inner Moon, Julian and the Moon Maid escape from the satellite in the marvelous interplanetary cruiser, the Barsoom. Read the final chapters of this thrilling story beginning on the next page.

MOON *by* EDGAR RICE BURROUGHS

Author of "TARZAN of the APES"

LOST in the heart of the Moon, the hero of this astonishing tale of weird adventure defends the beautiful Moon Princess from the attack of a host of lunar swordsmen and battles terrific odds in one of the most remarkable stories ever published.

WHEN the interplanetary cruiser *Barsoom* left the surface of the earth in the year 2025 to begin its voyage to the planet Mars, I was in charge of the ship. I am Julian, narrator of this astonishing tale of the almost unbelievable adventures which befell us five adventurers who set forth to penetrate the uncharted wastes of space.

Commander Orthis, an ancient enemy of mine, was second in command. The feud between us was of long duration, having begun during our cadet days when he resented my superiority on the field of sports. His disposition was naturally vengeful, but I never suspected the lengths to which his resentment would lead him. But that comes later.

It was Orthis who discovered the Eighth Ray, the mysterious force which enabled the *Barsoom* to travel through space. It was Orthis who designed the Eighth Ray tanks of the *Barsoom*. His hatred of me did not take on an ugly shape, however, until I discovered that he had broken into our store of spirits and drunk himself into a frenzied rage. Then he swung an axe on our Eighth Ray tanks and we fell helplessly toward the Moon.

We drifted through a crater and came to land in a marvelous world inside the Moon. Orthis and I were investigating the country one day when we were pursued and captured by the savage Va-gas, half-horse, half-human creatures of the Moon. In their captivity was also Nah-ee-lah, the beautiful human princess of the tribe of Laythe. We escaped our bestial captors and made our way to the city of Laythe, a marvelous pillar of terraces and columns which rose upward more than a mile.

Ko-tah, one of the nobles of Laythe, was secretly conspiring to overthrow Nah-ee-lah's father, Sagroth, Jemadar of Laythe. Learning of the plot, I rushed to the apartments of the Jemadar to warn him. While I was there the henchmen of Ko-tah burst into the chamber with drawn swords.

"Defend yourself, Sagroth, Jemadar of Laythe!" I cried, drawing my own sword and standing at his side. Together we met the assault of Ko-tah's swordsmen. As I engaged my opponent there broke above the clang of steel a girl's voice—Nah-ee-lah's—raised in accents of fear.

"Julian, beware! Behind you! Behind you!"

The Final Chapter

AT THE instant of her warning the eyes of my antagonist left mine, which, for his own good, they never should have done, and passed in a quick glance over my shoulder at something or someone behind me. His lack of concentration cost him his life. I saw my opening the instant that it was made, and with a quick lunge I passed my blade through his heart. Whipping it out again, I wheeled to face a dozen men springing into the chamber. They paid no attention to me, but leaped toward Sagroth, and before I could prevent he went down with half a dozen blades through his body.

Upon the opposite side of the desk from us was another doorway directly behind Nah-ee-lah, and in the instant that she saw Sagroth fall, she called to me in a low voice: "Come, Julian, quick! Or we, too, are lost."

Realizing that the Jemadar was dead and that it would be folly to remain and attempt to fight this whole roomful of warriors, I

leaped the desk and followed Nah-ee-lah through the doorway beyond.

"Julian," she said, "how can you ever forgive me? You who have risked your life for the Jemadar, my father, in spite of the contemptible treatment that in my ignorance I have accorded you?"

"I could have explained," I said, "but you would not let me. Appearances were against me, and so I cannot blame you for thinking as you did."

Together, hand in hand, we ran along the corridors of the Jemadar's palace to the highest terrace of Laythe, where I had left the *Barsoom* and its crew. But as we came up the last flight of steps I paused in astonishment and dismay, while my heart sank like lead within me. The *Barsoom* was gone—disappeared as completely as if the earth had swallowed it!

A hundred men stood on the terrace and they had evidently learned of what had

DICTAPHONE AIDS COMPOSERS

CYRIL SCOTT, famous composer, is shown in the photograph playing his piano for the recording ear of a dictaphone. The instrument records the improvisations which otherwise might be lost to memory as soon as they have been played. The wax disc of the dictaphone faithfully records the different notes and it is a simple task to transcribe the music from the wax to a permanent written record. If it develops that there is nothing worthy of preservation in the improvisations, the wax cylinder is shaved off and is ready for further service.

"It was wicked of me not to listen to you, Julian, but I thought that Ko-tah had won you over, as he has won over even some of the staunchest friends of Sagroth."

"You might have known, Nah-ee-lah, that even could I have been disloyal to your father, I never could have been disloyal to his daughter."

"I did not know," she said. "How could I?"

There suddenly came over me a great desire to take her in my arms and cover over those lovely lips with kisses. I could not tell why this ridiculous obsession had seized upon me, nor why, of a sudden, I became afraid of little Nah-ee-lah, the Moon Maid. I must have looked very foolish indeed, standing there looking at her, and suddenly I realized how fatuous I must appear, and so I shook myself and laughed.

"Come, Nah-ee-lah," I said, "we must not remain here. On the outer terrace there rests the machine of steel which brought me from my own land. It is waiting to take us out of this world of strife back to my native soil."

occurred within the palace, for they drew their swords and surrounded Nah-ee-lah, shouting:

"To the death for Nah-ee-lah, Jemadav of Laythe!"

They wanted to remain there and protect her, but I told them that there would be nothing gained by that, that sooner or later they would be overwhelmed by far greater numbers, and the cause of Nah-ee-lah lost.

"Send a dozen men," I said to their commander, "to rally all of the loyal guards that remain alive. As for us, we will accompany Nah-ee-lah immediately to the throne room, and there, place her upon the throne and proclaim her ruler of Laythe. A hundred men may hold the throne room for a long time, if we reach it before Ko-tah reaches it with his forces."

The officer looked at Nah-ee-lah questioningly.

"Your command, Jemadav?" he inquired.

"We will follow the plan of Ju-lan the Javadar," she replied.

The Kalkars Attack

IMMEDIATELY a dozen warriors were dispatched to rally the Imperial Guard and arouse the loyal citizens of the city to the protection of their new Jemadav, while the balance of us conducted Nah-ee-lah by a short course toward the throne room.

As we entered the great chamber at one end, Ko-tah and a handful of warriors came in at the other, but we had the advantage, in that we entered through a doorway directly behind the throne and upon the dais.

"Throw your men upon the main entrance." I called to the officer of the guard, "and hold it until reenforcements come"; and then, as the hundred raced the length of the throne room toward the surprised and enraged Ko-tah, I led Nah-ee-lah to the central throne and seated her upon it. Then stepping forward, I raised my hand for silence.

"The Jemadar Sagroth is dead!" I cried. "Behold Nah-ee-lah, the Jemadav of Laythe!"

"Stop!" cried Ko-tah, "she may share the throne with me, but she may not possess it alone."

"Take that traitor!" I called to the loyal guard, and they rushed forward, evidently glad to do my bidding. But Ko-tah did not wait to be taken. He was accompanied by only a handful of men, and when he saw that the guard really intended to seize him and realized that he would be given short shrift at the hands of Nah-ee-lah and myself, he turned and fled. But I knew he would come back, and come back he did, though not until after the majority of the Jemadav's guard had gathered within the throne room.

He came with a great concourse of warriors, and the fighting was furious, but he might have brought a million men against our thousand and not immediately have overcome us, since only a limited number could fight at one time in the entrance way to the throne room. Already the corpses lay stacked as high as a man's head, yet no single member of Ko-tah's forces had crossed the threshold.

How long the fight was waged I do not know, but it must have been for a considerable time.

After a time there arose slowly a deep-toned sound. It rose and fell in increasing volume, until finally we knew that it was the sound of human voices, the voices of a great mob—of a mighty concourse of people and that it was sweeping toward us slowly and resistlessly.

Closer and closer it approached the palace as it rose, terrace upon terrace, toward the lofty pinnacle of Laythe. The fighting at the entrance to the throne room had almost ceased. Both sides were worn down almost to utter exhaustion, and now we but stood upon our arms upon either side of the wall of corpses that lay between us, our attention centered upon the sound of the growling multitude that was sweeping slowly upward toward us.

"They come," cried one of Nah-ee-lah's nobles, "to acclaim the new Jemadav and to tear the minions of Ko-tah the traitor to pieces!"

SUITCASE CARRIES BICYCLE

A MAN-SIZE bicycle which can be folded up and carried about in a suitcase is shown in the picture at the right. It can be carried about handily by the traveler, the entire weight of the machine being only 20 pounds. The separate sections of the bicycle are shown lying on the floor. The wheels are smaller than those on an ordinary machine, but are large enough to maintain an average pace of 20 miles an hour.

The Death of Ko-tah

HE SPOKE in a loud voice that was easily audible to Ko-tah and his retainers in the corridor without.

"They come to drag the spawn of Sagroth from the throne!" cried one of Ko-tah's followers. We could hear the shouting horde moving through the corridor and chambers, and finally the muffled bellowing resolved itself into articulate words:

Ko-tah's forces, now augmented by the rabble, were pushing their way over the corpses and into the throne room, so that we were forced to join the defenders, that we might hold them off while life remained to any of us. When the commander of the guard saw me fighting at his side he asked me to return to Nah-ee-lah.

"We must not leave the Jemadav alone," he said. "Return and remain at her side, Ju-lan the Javadar, and when the last of us has fallen, drive your dagger into her heart."

I shuddered and turned back toward Nah-ee-lah. As I reached Nah-ee-lah's side, and turned again to face the entrance to the throne room, I saw that the warriors of Ko-tah were being pushed into the chamber by the mob behind them and that our defenders were being overwhelmed by the great number of their antagonists. Ko-tah, with a half dozen warriors, had been carried forward, practically without volition, by the press of numbers in their rear, and even now, with none to intercept him, was running rapidly up the broad center aisle toward the throne. Some of those in the entrance way saw him, and as he reached the foot of the steps leading to the dais, a snarling cry arose:

"Ko-tah the Jemadar!"

With bared sword, the fellow leaped to-

Note the little half-moon extending from the end of this pipe stem. It helps smokers with false teeth to hold the pipe in the mouth.

PIPE FOR FALSE TEETH SMOKERS

PIPE smokers who wear false teeth can now enjoy the use of a pipe with a specially designed mouthpiece which enables it to be held easily in the mouth. The photograph clearly shows the semi-circular projection extending from the pipe stem. This mouthpiece rests along the top of the false teeth and helps to support the pipe in the mouth. It is the invention of an Englishman who designed it originally for his own use and then decided to market his idea when he found how popular and practical the pipe was. The photo was taken at the International Inventions Exhibition recently held at London, where new inventions from all corners of the globe were exhibited.

"Sagroth is no more! Rule, Ko-tah, Jemadar of Laythe!"

I turned in consternation toward Nah-ee-lah. "What does it mean?" I cried. "Have the people turned against you?"

"Ko-tah's minions have done their work well during these many kelds," said the commander of the Jemadav's guard, who stood upon the upper steps of the dais just below the throne. "They have spread lies and sedition among the people which not even Sagroth's just and kindly reign could overcome."

"Let the will of the people be done," said Nah-ee-lah.

"It is the will of fools betrayed by a scoundrel," cried the commander of the guard. "While there beats a single heart beneath the tunic of a guardsman of the Jemadav, we shall fight for Nah-ee-lah, Empress of Laythe."

ward me where I stood alone between Nah-ee-lah and her enemies.

"Surrender, Julian!" she cried. "It is futile to oppose them."

"Ko-tah the traitor shall never sit upon the throne of Nah-ee-lah!" I exclaimed, and leaping forward, I engaged the Prince of Laythe.

His warriors were close behind him, and it behooved me to work fast, and so I fought as I had never guessed that it lay within me to fight, and at the instant that the rabble broke through the remaining defenders and poured into the throne room of the Jemadars of Laythe, I slipped my point into the heart of Ko-tah. With a single piercing shriek, he threw his hands above his head and toppled backward down the steps to lie dead at the foot of the throne he had betrayed.

For an instant the silence of death reigned in the great chamber. Friend and foe stood alike in the momentary paralysis of shocked surprise.

arose the shrieks and screams of terrified people. Again the palace trembled, and a great crack opened in one of the walls of the throne room. The people saw it, and in an instant their anger against the dynasty of Sagroth was swallowed in the mortal terror which they felt for their own safety. With shrieks and screams they turned and bolted for the doorway.

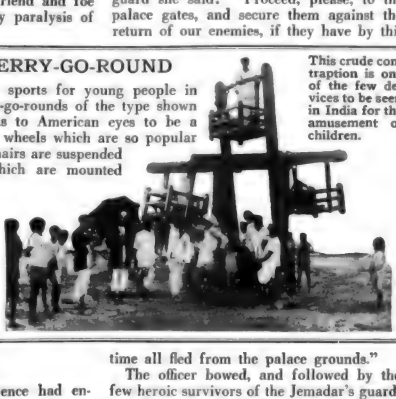
Explosion after explosion followed one another in rapid succession. The people had fled. The palace was empty, except for that handful of us faithful ones who remained within the throne room.

"Let us go," I said to Nah-ee-lah, "and discover the origin of these sounds, and the extent of the damage that is being done."

"Come," she said, "here is a short corridor to the inner terrace, where we may look down upon the entire city of Laythe." And then, turning to the commander of the guard she said: "Proceed, please, to the palace gates, and secure them against the return of our enemies, if they have by this

EAST INDIAN MERRY-GO-ROUND

ONE of the most popular sports for young people in India is riding in merry-go-rounds of the type shown in the photograph. It seems to American eyes to be a crude imitation of the Ferris wheels which are so popular in amusement parks. Four chairs are suspended from X-like cross pieces which are mounted on uprights. The device is propelled by man power, and when it gets into action its squeaks can be heard for a long distance, since the axles are never greased. A group of Indian children are shown waiting their turn to ride.



This crude contraption is one of the few devices to be seen in India for the amusement of children.

Attacked!

THAT tense, breathless silence had endured for but a moment, when it was shattered by a terrific detonation. We felt the palace tremble and rock. The assembled mob looked wildly about, their eyes filled with fear and questioning. But before they could voice a question, another thunderous report burst upon our startled ears, and then from the city below the palace there time all fled from the palace grounds."

The officer bowed, and followed by the few heroic survivors of the Jemadar's guard, he left by another corridor for the palace gates, while I followed Nah-ee-lah up a stairway that led to the roof of the palace.

Coming out upon the upper terrace, we made our way quickly to the edge overlooking the city and the crater. Below us a shrieking multitude ran hither and thither from terrace to terrace, while, now here

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CONQUEST OF THE MOON

and now there, terrific explosions occurred that shattered age-old structures and carried debris high into the air.

But an instant it took me to realize that the explosions were caused by something that was being dropped into the city from above, and as I looked up I saw a missile describing an arc above the palace, past which it hurtled to a terrace far below, and at once I realized that the missile had originated outside the city. Turning quickly, I ran across the terrace to the outer side which overlooked the plateau upon which the city stood. I could not repress an exclamation of astonishment at the sight that greeted my eyes, for the surface of the plateau was alive with warriors. Nah-ee-lah had followed me and was standing at my elbow. "The Kalkars," she said. "They have come again to reduce Laythe. It has been long since they attempted it, many generations ago, but what is it, Julian, that causes the great noise and the destruction and the fires within Laythe?"

Orthis Reappears

AS WE stood there talking, one of the Jemadar's guards emerged from the palace and approached us.

"Nah-ee-lah, Jemadav," he cried, "there is one here who craves audience with you and who says that if you listen to him you may save your city from destruction."

"Fetch him," replied Nah-ee-lah. "We will receive him here."

We had but a moment to wait when the guardsman returned with one of Ko-tah's captains.

"Nah-ee-lah, Jemadav," he cried, when she had given him permission to speak. "I come to you with a message from one who is Jemadar of Jemadars, ruler of all Va-nah. If you would save your city and your people, listen well."

The girl's eyes narrowed. "You are speaking to your Jemadav, fellow," she said. "Be careful, not only of your words, but of your tone."

"I come but to save you," replied the man sullenly. "The Kalkars have discovered a great leader, and they have joined together from many cities to overthrow Laythe. My master does not wish to destroy

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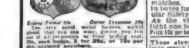

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CONQUEST OF THE MOON

this ancient city, and there is but one simple condition upon which he will spare it."

"Name your condition," said Nah-ee-lah.

"If you will wed him, he will make Laythe the capital of Va-nah, and you shall rule with him as Jemadav of Jemadavs."

Nah-ee-lah's lips curled in scorn. "And who is the presumptuous Kalkar that dares aspire to the hand of Nah-ee-lah?" she demanded.

"He is no Kalkar, Jemadav," replied the messenger. "He is one from another world, who says that he knows you well and that he has loved you long."

"His name," snapped Nah-ee-lah impatiently.

"He is called Or-tis, Jemadar of Jemadars."

Nah-ee-lah turned toward me with elevated brows and a smile of comprehension upon her face.

"Or-tis," she repeated.

"Now, I understand, my Jemadav," I said, "and I am commencing to have some slight conception of the time that must have elapsed since I first landed within Va-nah, for even since our escape from the Va-gas Or-this has had time to discover the Kalkars and ingratiate himself among them, to conspire with them for the overthrow of Laythe, and to manufacture explosives and shells and the guns which are reducing Laythe this moment."

"Go back to your master," she said to the messenger, "and tell him that Nah-ee-lah, Jemadav of Laythe, would as leave mate with Ga-va-go the Va-ga as with him, and that Laythe will be happier destroyed and her people wiped from the face of Va-nah than ruled by such a beast. I have spoken. Go."

She stood and thought for a long time.

"Go into the city," she said to the officer of the guard, "and gather every Laythean who can carry a sword, a dagger, or a lance. Tell them to assemble on the inner terraces below the castle, and that I, Nah-ee-lah their Jemadav, will address them. The fate of Laythe rests with you. Go."

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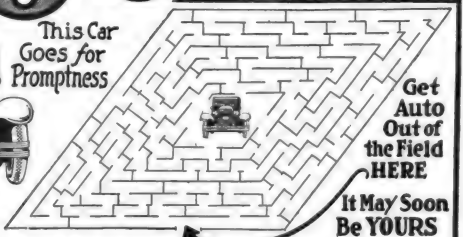

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CONQUEST OF THE MOON

THE city was already in flames in many places, and though the people fought valiantly to extinguish them, it seemed to me that they but spread the more rapidly with each succeeding minute. And then, as suddenly as it had commenced, the bombardment ceased. Nah-ee-lah and I crossed over to the outer edge of the terrace to see if we could note any new movement by the enemy, nor did we have long to wait. We saw a hundred ladders raised as if by magic toward the lowest terrace, which rose but a bare two hundred feet above the base of the city.

When I saw what was happening I ran quickly down into the palace and out upon the terrace before the gates, where the remainder of the guard were stationed, and there I told them what was happening and urged them to hasten the people to the lowest terrace to repulse the enemy before they had secured a foothold upon the city. Then I returned to Nah-ee-lah, and together we watched the outcome of the struggle.

We saw the defenders rush forth to attack them, and for a moment, so impetuous was their charge, I thought that I had been wrong and that the Kalkars might yet be driven from Laythe. Fighting upon the lower outer terrace far beneath us was a surging mass of shouting warriors. The Kalkars were falling back before the impetuous onslaught of the Laytheans.

But suddenly a new force seemed to be injected into the strife. I saw a stream of Kalkars emerging above the edge of the lower terrace—new men clambering up the ladders from the plateau below, and as they came they shouted something which I could not understand, but the other Kalkars seemed to take heart and made once more the semblance of a stand against the noble Laytheans, and I saw one, the leader of the newcomers, force his way into the battling throng. And then I saw him raise his hand above his head and hurl something into the midst of the compact ranks of the Laytheans.

Instantly there was a terrific explosion and a great, bloody gap lay upon the terrace where an instant before a hundred of the flower of the fighting men of Laythe had

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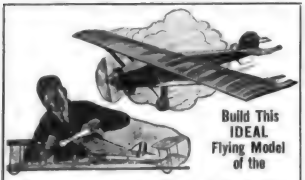

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CONQUEST OF THE MOON

been so gloriously defending their city and their honor.

"Grenades," I exclaimed. "Hand grenades!"

The End of the World

NAH-EE-LAH laid her head upon my shoulder and wept softly. "Julian," she said at last, "this is the end, then. Take me to the Jemadav, my mother, please, and then you must go and make your peace with your fellow Earth Man. It is not right that you, a stranger, who have done so much for me, should fall with me and Laythe."

"The only peace I can make with Orthis, Nah-ee-lah," I replied, "is the peace of death. Orthis and I may not live together again in the same world."

She was crying very softly, sobbing upon my shoulder, and I put my arm about her in an effort to quiet her.

"I have brought you only suffering and danger, and now death, Julian," she said, "when you deserve naught but happiness and peace."

"Nah-ee-lah," I said, "I do not fear death if you must die, and I do not seek happiness except with you."

She looked up suddenly, her great, tear-dimmed eyes wide and gazing deep into mine.

"You mean—Julian? You mean—?"

"I mean, Nah-ee-lah, that I love you," I replied, though I must have stumbled through the words in a most ridiculous manner, so frightened was I.

"Ah, Julian," she sighed, and put her arms about my neck.

"And you, Nah-ee-lah!" I exclaimed incredulously, as I crushed her to me, "can it be that you return my love?"

"I have loved you always," she replied. "From the very first, almost—way back when we were prisoners together in the Novans village. You Earth Men must be very blind, my Julian. A Laythean would have known it at once, for it seemed to me that upon a dozen occasions I almost avowed my love openly to you."

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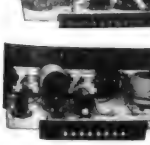

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CONQUEST OF THE MOON

"WE HAD no chance to save the city," said Nah-ee-lah, with a sigh. "Our people, called from their normal duties by the false Ko-tah, were leaderless. The fire fighters, instead of being at their posts, were seeking the life of their Jemadar. Unhappy day! Unhappy day!"

As we stood watching the flames we suddenly saw people emerging in great numbers upon several of the lower terraces. They were evidently in terrified flight, and then others appeared upon terraces above them—Kalkars who hurled hand grenades amongst the Laytheans beneath them.

Nah-ee-lah turned away. "Come, Julian," she said, "I cannot look, I cannot look." And together we walked across the terrace to the outer side of the city.

Almost directly beneath us upon the next terrace was a palace gate and as we reached a point where we could see it, I was horrified to see that the Kalkars had made their way up the outer terraces to the very palace walls. The great stone gates would have held indefinitely against spears and swords, but even the guardsmen must have guessed that their doom was already sealed and that these gates, that had stood for ages, an ample protection to the Jemadars of Laythe, were about to fall, as the Kalkars halted fifty yards away, and from their ranks a single individual stepped forth a few paces.

As my eyes alighted upon him I seized Nah-ee-lah's arm. "Orthis!" I cried. "It is Orthis." At the same instant the man's eyes rose above the gates and fell upon us. A nasty leer curled his lips as he recognized us.

"I come to claim my bride," he cried, in a voice that reached us easily, "and to balance my account with you, at last," and he pointed a finger at me.

In his right hand he held a large, cylindrical object, and as he ceased speaking he hurled it at the gates precisely as a baseball pitcher pitches a swift ball.

The missile struck squarely at the bottom of the gates. There was a terrific explosion, and the great stone portals crumbled, shattered into a thousand fragments.

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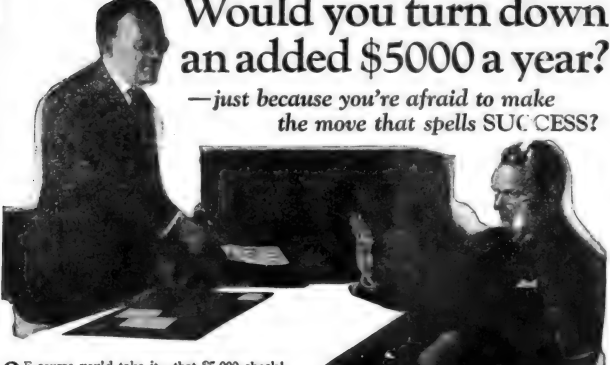

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CONQUEST OF THE MOON

hurling hand grenades among the survivors of the guard.

Nah-ee-lah turned toward me and put her arms about my neck.

"Kiss me once more, Julian," she said. "and then the dagger."

"Never, never, Nah-ee-lah!" I cried. "I cannot do it."

"But I can!" she exclaimed, and drew her own from its sheath at her hip.

I seized her wrist. "Not that, Nah-ee-lah!" I cried. "There must be some other way." And then there came to me a mad inspiration. "The wings!" I cried. "Where are they kept? The last of your people have been destroyed. Duty no longer holds you here. Let us escape, even if it is only to frustrate Orthis' plans and deny him the satisfaction of witnessing our death."

Floating Wings

"YOU are right, Julian. We still have a little time, for I doubt if Orthis or his Kalkars can quickly find the stairway leading to this terrace." And then she led me quickly to one of the many towers that rise above the palace. Entering it, we ascended a spiral staircase to a large chamber at the summit of the tower. Here were kept the imperial wings. I fastened Nah-ee-lah's to her and she helped me with mine, and then from the pinnacle of the tower we arose above the burning city of Laythe and flew rapidly toward the distant lowlands and the sea. It was in my mind to search out, if possible, the location of *The Barsoom*, for I still entertained the mad hope that it was near by.

The heat above the city was almost unendurable and the smoke suffocating, yet we passed through it, so that almost immediately we were hidden from the view of that portion of the palace from which we had arisen, with the result that when Orthis and his Kalkars finally found their way to the upper terrace, as I have no doubt they did, we had disappeared—whither they could not know.

Our long flight must have covered a considerable period of time, since it was necessary for us to alight and rest many times and to search for food. We met, fortunate-

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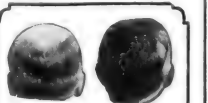

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CONQUEST OF THE MOON

ly, with no mishaps, and upon the several occasions when we were discovered by roving bands of Va-gas we were able to soar aloft and escape them easily. We came at length, however, to the sea, the coast of which I followed to the left, but though we passed the mouths of many rivers, I discovered none that precisely answered the description of that which I sought.

Off the coast we had seen islands almost continuously and I suggested to Nah-ee-lah that we try to discover one upon which grew the fruits and nuts and vegetables necessary for our subsistence, and where we might also have a constant supply of fresh water.

It was a beautiful spot, a veritable Garden of Eden, where we two might have passed the remainder of our lives in peace and security, for though we later explored it carefully, we found not the slightest evidence that it had ever known the foot of man.

Return of The Barsoom

TOGETHER we built a snug shelter against the storms. Together we hunted for food, and during our long periods of idleness we lay upon the soft sward beside the beach, and to pass the time away, I taught Nah-ee-lah my own language.

We had, however, given up definitely hope for any other form of existence. And thus we were lying one time, as was our wont after eating, stretched in luxurious ease upon our backs on the soft lunar grasses, I with my eyes closed, when Nah-ee-lah suddenly grasped me by the arm.

"Julian," she cried, "what is it? Look!"

As my eyes rested upon the thing her pointing finger indicated, I leaped to my feet with an exclamation of incredulity, for there, sailing parallel with the coast at an altitude of not more than a thousand feet, was a ship, the lines of which I knew as I had known my mother's face. It was *The Barsoom.*

Grasping Nah-ee-lah by the arm, I dragged her to her feet. "Come, quick, Nah-ee-lah!" I cried, and urged her rapidly toward our hut, where we had stored the wings and the gas bags which we had never thought to use again, yet protected carefully, though why we knew not.

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CONQUEST OF THE MOON

There was still gas in the bags—enough to support us in the air, with the assistance of our wings, but to fly thus for long distances would have been most fatiguing, and there was even a question as to whether we could cross the ten miles of sea that lay between us and the mainland; yet I was determined to attempt it. Hastily we donned the wings, and bags, and rising together, flapped slowly in the direction of the mainland.

The Barsoom was cruising slowly along a line that would cross ours before we could reach the shore, but I hoped that they would sight us and investigate.

We flew as rapidly as I dared, for I could take no chances upon exhausting Nah-ee-lah, knowing that it would be absolutely impossible for me to support her weight and my own, with our depleted gas bags.

And yet I struggled on, my lungs almost bursting from the exertion of my mad efforts toward speed. Nah-ee-lah trailed far behind, for if either of us could reach *The Barsoom* in time we should both be saved, and I could fly faster than Nah-ee-lah; otherwise, I should never have separated myself from her by so much as a hundred yards.

As I came into view directly above *The Barsoom* West whipped out his revolver and leveled it at me, but the instant that his finger pressed the trigger Norton sprang forward and struck his hand aside.

"My God, sir!" I heard the boy cry, "it is the Captain." And then they all recognized me, and an instant later I almost collapsed as I fell to the deck of my beloved ship.

My first thought was of Nah-ee-lah, and at my direction *The Barsoom* rose swiftly and moved to meet her.

After we had taken her aboard the ship and set out through the crater on our return journey to the earth, I learned how *The Barsoom* had disappeared so mysteriously from the terraces of Laythe. It seemed that one of the repaired Eighth Ray tanks had burst, with the result that *The Barsoom*, utterly out of control, had careened off into space. When Norton had effected a repair and returned to the city,

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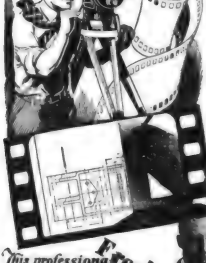

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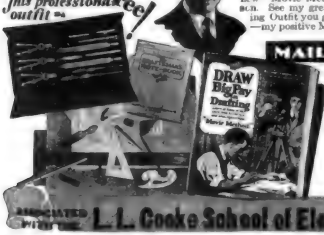

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CONQUEST OF THE MOON

it was too late—the tower was a crumbling pinnacle of flame.

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So, with my arm about Nah-ee-lah, I stood on the bridge of *The Barsoom* and together we watched the moon country drift away until we approached the outer crust and it came time to set the protection of the cabins inside the ship.

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LOST INSIDE THE EARTH

(Continued from page 125)

back, dealt the brute a terrific blow. Releasing his hold upon the tree he dropped on all-fours and at the same time swung his great, wicked tail with a force that would have broken every bone in my body had it struck me.

As it started in pursuit of me I made the mistake of running along the edge of the forest rather than making for the open beach. In a moment I was knee-deep in rotting vegetation, and the awful thing behind me was gaining rapidly as I floundered and fell in my efforts to extricate myself.

In the Hands of the Ape-Men

A FALLEN log gave me an instant's advantage, for climbing upon it I leaped to another a few paces farther on, and in this way was able to keep clear of the mush that carpeted the surrounding ground.

Suddenly from behind I heard a tumult of howls, and sharp, piercing barks—much the sound that a pack of wolves raises when in full cry.

My mammoth enemy was so close by this time that I knew I must feel the weight of one of his terrible paws before I could rise, but to my surprise the blow did not fall upon me. The howling and snapping and barking of the new element which had been infused into the mêlée now seemed centered quite close behind me, and as I raised myself upon my hands and glanced around I saw what it was that had distracted the *dyryth*, as I afterward learned the thing is called, from my trail.

It was surrounded by a pack of some hundred wolf-like creatures—wild dogs they seemed—that rushed growling and snapping in upon it from all sides, so that they sank their white fangs into the slow brute and were away again before it could reach them with its huge paws or sweeping tail.

But these were not all that my startled eyes perceived. Chattering and gibbering through the lower branches of the trees came a company of man-like creatures evidently urging on the dog pack. They were to all appearances strikingly similar in aspect to the Negros of Africa. Their skins were very black, and their features much like those of the more pronounced Negroid type except that the head receded more rapidly above

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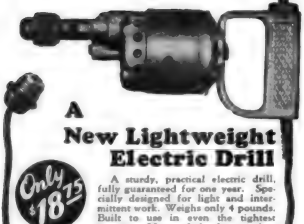

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LOST INSIDE THE EARTH

the eyes, leaving little or no forehead. Their arms were rather longer and their legs shorter in proportion to the torso than in man, and later I noticed that their great toes protruded at right angles from their feet—because of their arboreal habits, I presume. Behind them trailed long, slender tails which they used in climbing quite as much as they did either their hands or feet.

Captured!

I HAD stumbled to my feet the moment that I discovered that the wolf-dogs were holding the dyryth at bay. At sight of me several of the savage creatures left off worrying the great brute to come slinking with bared fangs toward me, and as I turned to run toward the trees again to seek safety among the lower branches, I saw a number of the man-apes leaping and chattering in the foliage of the nearest tree.

Between them and the beasts behind me there was little choice, but at least there was a doubt as to the reception these grotesque parodies on humanity would accord me.

And so I raced on toward the trees intending to pass beneath that which held the man-things and take refuge in another farther on; but the wolf-dogs were very close behind me—so close that I had despaired of escaping them, when one of the creatures in the tree above swung down headforemost, his tail looped about a great limb, and grasping me beneath my armpits swung me in safety up among his fellows.

When they had examined me for a few moments one of them discovered that my clothing was not a part of me, with the result that garment by garment they tore it from me amidst peals of the wildest laughter.

In the meantime I had been straining my eyes to catch a glimpse of Perry, but nowhere about could I see him, although the clump of trees in which he had first taken refuge was in full view. I was much exercised by fear that something had befallen him, and though I called his name aloud several times there was no response.

Tired at last of playing with my clothing the creatures threw it to the ground, and catching me, one on either side, by an arm,

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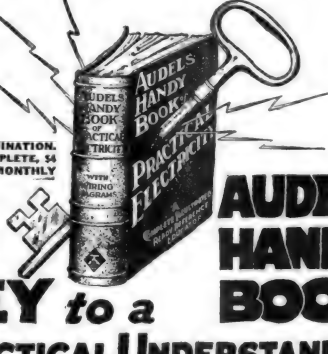

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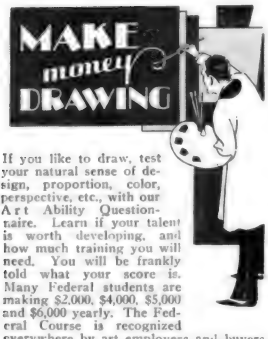

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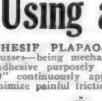

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LOST INSIDE THE EARTH

started off at a most terrifying pace through the tree tops.

At the Earth's Heart

WE MUST have traveled several miles through the dark and dismal wood when we came suddenly upon a dense village built high among the branches of the trees.

It consisted of several hundred rude shelters of boughs and leaves supported upon the branches of the trees. Between the huts, which sometimes formed crooked streets, were dead branches and the trunks of small trees which connected the huts upon one tree to those within adjoining trees.

My guard halted before one of the huts into which I was pushed; then two of the creatures squatted down before the entrance—to prevent my escape, doubtless. Though where I should have escaped to I certainly had not the remotest conception.

I had no more than entered the dark shadows of the interior than there fell upon my ears the tones of a familiar voice, in prayer.

"Perry!" I cried. "Dear old Perry! Thank the Lord you are safe."

"David! Can it be possible that you escaped?" And the old man stumbled toward me and threw his arms about me.

"I wonder what the creatures intend doing with us, Perry," I remarked. "They don't seem really savage. What do you suppose they can be? You were about to tell me where we are when that great hairy frigate bore down upon us—have you really any idea at all?"

"Yes, David," he replied. "I know precisely where we are. We have made a magnificent discovery, my boy. We have proved that the earth is hollow. We have passed entirely through its crust to the inner world."

"Perry, you are mad!"

"Not at all, David. For two hundred and fifty miles our prospector bore us through the crust beneath our outer world. At that point it reached the center of gravity of the five-hundred-mile-thick crust. Up to that point we had been descending—direction is, of course, merely relative. Then at the moment that our seats revolved—the thing

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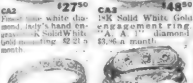

CA3 18K Solid White Gold engagement ring. Fancy engraved mounting, set with 3 fine blue white diamonds. $3.96 a month. **$48.50**

CA6 Handsome engraved 18K White Gold wedding ring, 5 genuine blue white diamonds. 75c a month. **$29.50**

CA7 New lady's friendship ring, 18K Solid White Gold, 3 perfectly matched, blue white diamonds. $2.96 a mo. **$36.75**

CA10 Exquisitely hand engraved pierced 18K Solid White Gold lady's ring. Finest genuine blue white diamond. $3.04 a month. **$37.50**

CA11 Gents 14K solid Green Gold ring, 18K white gold top. "A. A. 1". blue white diamond $3.96 a month. **$47.50**

ELGIN "Persistence" Model

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CA12-The "Madam Jenny" The latest from Paris, engraving and fashion vogue. Guaranteed **Elgin** movement. An dependable as it is beautiful. Supplied in GREEN JADE, BLACK or RUBY ENAMEL. $2.50 a month.

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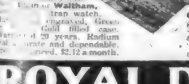
CA13 Handsomely silver-... Elgin or Waltham ... tran watch, ... engraved, Green ... Gold filled case. ... Warranted 20 years. Medium ... Complete and dependable. ... graved. $2.12 a month.



CA4 Dazzling cluster of ... perfectly matched, finest quality blue white diamonds, 18K Solid White Gold mounting. $3.04 a mo. **$48.50**

CA5 The "Persistence" ... 18K Solid White Gold engagement ring, hand carved floral design ... finest grade, blue white diamond. $6.16 a month. **$75.00**

CA8 The "Magnificent" 18K Solid White Gold, beautifully hand pierced lady's mounting. Finest grade, genuine blue white diamond. $4.71 a month. **$57.00**

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CA14-The "Princess Pat". 14-K SOLID WHITE GOLD, engraved case, dependable, 15 jewel movement. Genuine "WRISTACRAT" flexible bracelet. $2.00 a mo.

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CA16-Ultra fashionable, diamond wrist watch, hand engraved 14-K SOLID WHITE GOLD case, 15 ruby and sapphire jewelled movement, 5 blue white diamonds, 4 French blue sapphires. Genuine "WRISTACRAT" bracelet, patented safety clasp. $2.79 a month. **$34.50**

CA15 Handsome 18K Solid White Gold engagement ring, 3 genuine blue white diamonds. $2.50 a month. **$32.50**

CA18 Gents massive 14K solid white gold ring, hand engraved, 18K white gold top, genuine blue white diamond. $3.96 a month. **$47.50**

CA19 Gents massive 14K solid white gold ring, hand engraved, 18K white gold top, genuine blue white diamond. $3.96 a month. **$47.50**

CA20 Gents massive 14K solid white gold ring, hand engraved, 18K white gold top, genuine blue white diamond. $3.96 a month. **$47.50**

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LOST INSIDE THE EARTH

that made you believe that we had turned about and were speeding upward—we passed the center of gravity and, though we did not alter the direction of our progress, yet we were really moving upward—toward the surface of the inner world."

"But the sun, Perry!" I urged. "How in the world can the sun shine through five hundred miles of solid crust?"

"It is not the sun of the outer world that we see here. It is another sun—an entirely different sun—that casts its eternal noonday effulgence upon the face of the inner world. It is still in the exact center of the heavens. We have been here for many hours—yet it is still noon.

"And withal it is very simple, David. The earth was once a nebulous mass. It cooled, and as it cooled it shrank. At length a thin crust of solid matter formed upon its outer surface—a shell; but within it was partially molten matter and highly expanded gases. As it continued to cool, what happened? Centrifugal force hurled the particles of the nebulous center toward the crust as rapidly as they approached a solid state. Presently there was only a small superheated core of gaseous matter remain-

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In the window, top, body, wheel, or under the fender of the Buick Sedan pictured here are certain lucky letters cleverly worked into the picture by the artist. If you find even one of these letters which appears in your last name?

TELL ME the letter you have found in the sun. Remember, this letter must appear somewhere in your last name. Send it to me with your name and address. I am giving away four autos and many other prizes. You may be the one who will write me

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There are 7 cars in the circle. By drawing 3 straight lines you can put each one in a space by itself. When you do this send me your answer right away.

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In addition to the many valuable prizes and Hundreds of Dollars in Cash, we are also giving a Special Prize of $750.00 in Cash for Promptness. First prize winner will receive $2,750.00 in cash, or the Nash Sedan and $750.00 in cash. In case of ties duplicate prizes will be awarded each one tying. Solve the puzzle right away and send me your answer together with your name and address plainly written. $4,500.00 in prizes—EVERYBODY REWARDED.

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Win $3,500.00

Here's news for puzzle fans! C. W. Francis, A. F. Holt, Miss Leola Markus won from $1,800.00 to $3,-100.00 each in our last puzzles. Here's the new one. Here are twelve pictures of Charlie Chaplin, the world famous United Artists' star. No, they're not all alike, even though they look alike. Eleven of them are exactly alike, but one and only one is different from all the others. That's the real Charlie Chaplin. The difference may be in the tie, shirt or hat, or somewhere else.

Find the "Different" Picture

300 prizes totaling over $7,900.00. $2,500.00 to winner of first prize and duplicate prizes in case of ties. If you can find the "different" figure you may be the one to get this great prize.

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If you find the real Charlie Chaplin we will send as soon as correct answer is received certificate for $1,000.00 to add to the first prize of $2,500, if you win, and directions for getting largest prize. Over $50,-000.00 in prizes already given to advertise our products locally. No cost or obligation. Nothing to buy now, ever or ever. Everyone rewarded if actively interested.

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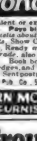

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LOST INSIDE THE EARTH

ing within a huge vacant interior left by the contraction of the cooling gases. The equal attraction of the solid crust from all directions maintained this luminous core in the exact center of the hollow globe. What remains of it is the sun you saw today—a relatively tiny thing at the exact center of the earth."

Further speculation was interrupted by the appearance of several of our captors before the entrance of the hut. Two of them entered and dragged us forth. The perilous pathways and the surrounding trees were filled with the black ape-man, their females, and their young. There was not an ornament, a weapon, or a garment among the lot.

"Quite low in the scale of creation," commented Perry.

"Quite high enough to play the deuce with us, though," I replied. "Now what do you suppose they intend doing with us?"

We were not long in learning. As on the occasion of our trip to the village we were seized by a couple of the powerful creatures and whirled away through the tree tops, while about us and in our wake raced a chattering, jibbering, grinning horde of sleek black ape-things.

Presently the forest terminated, and we came out upon a level plain. A short distance before us rose a few low, rocky hills. Toward these our captors urged us, and after a short time led us through a narrow pass into a tiny, circular valley. Here they got down to work, and we were soon convinced that if we were not to die to make a Roman holiday, we were to die for some other purpose.

We were placed in the center of the amphitheater—the thousand creatures forming a great ring about us. Then a wolf-dog was brought—*hyaendon* Perry called it—and turned loose with us inside the circle. As it slunk toward us it presented a most formidable aspect with its uncurled lips baring its mighty fangs.

Perry was on his knees praying. I stopped and picked up a small stone. At my movement the beast veered off a bit and commenced circling us. Evidently it had been a target for stones before. The ape-things were dancing up and down urging the brute on with savage cries, until at last, seeing that I did not throw, he charged us.

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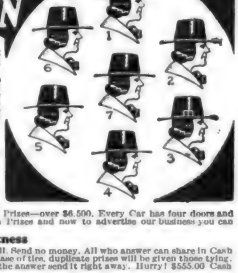

Here is a new puzzle that will be fun for you. In fact, you may win a Buick Sedan and $555.00 in cash, total $1,875.00, if you find the real John Alden and send your answer promptly.

Six of the pictures are exactly alike, but one, and only "one," is different from all the rest. See if you can find the different picture. If you do you may win a Buick Sedan and $555.00 cash extra, or $1,875.00 in cash. Hundreds have already won prizes. Lillie Bohle won $1500, Fred Steglinger won $3000, Mrs. R. T. Frederick won $1000, Robert F. Sullivan won $1000, and many others. You may be next. Everybody taking active part rewarded. You get your choice of Buick Sedan or $1875.00 cash. Send answer quick—You may be the one who will see this ad and solveit correctly

And WIN BUICK SEDAN or $1875

$555.00 check sent you at once as an additional prize as below if you answer quickly—As a reward for quick action—we send you check for $555 to add to First Prize Buick Sedan if you win, and directions for getting a 4-door Master Six Buick Sedan. Send answer at once. Costs nothing. No tricks or chances.

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I will give a beautiful Buick Sedan, also a Chrysler Sedan, also a Nash Sedan, also an Essex Sedan, and a Chevrolet Sedan—5 Cars and a large list of additional cash Prizes—over $6,500. Every Car has four doors and will be delivered FREE to winners by nearest auto dealers. Many have already won Prizes and now to advertise our business you can get this new Buick Sedan, or $1,875 Cash.

$555.00 Extra for Promptness

Be prompt. Just find the "one" picture of John Alden that is different from all the rest. Look carefully. They all look alike. But "one" is different. Send me the number of the "one" that is different with your name and address at once, then we will tell you how to win Buick. That's all. Send no money. All who answer can share in Cash and Prizes. In case of ties, duplicate prizes will be given those tying. If you can find the answer send it right away. Hurry! $555.00 Cash for promptness.

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LOST INSIDE THE EARTH

As I wound up for the delivery, I held my nerves and muscles under absolute command, though the grinning jaws were hurtling toward me at terrific speed. And then I let go, with every ounce of my weight and muscle and science back of that throw. The stone caught the hyaendon full upon the end of the nose, and sent him bowling over upon his back.

Captives in Chains

AT THE same instant a chorus of shrieks and howls arose from the circle of spectators. As I looked, the ape-things broke in all directions toward the surrounding hills, and then I distinguished the real cause of their perturbation. Behind them, streaming through the pass which leads into the valley, came a swarm of hairy men—gorilla-like creatures armed with spears and hatchets, and bearing long, oval shields.

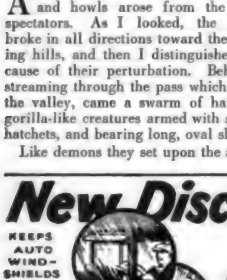
Like demons they set upon the ape-things. Past us swept the pursued and the pursuers, nor did the hairy ones accord us more than a passing glance until the arena had been emptied of its former occupants. Then they returned to us, and one who seemed to have authority among them directed that we be brought with them.

When we had passed out of the amphitheater onto the great plain we saw a caravan of men and women, human beings like ourselves.

But as we came closer, our hearts sank once more, for we discovered that the poor wretches were chained neck to neck in a long line, and that the gorilla-men were their guards. With little ceremony Perry and I were chained at the end of the line, and without further ado the interrupted march was resumed.

Our companions in chains strode along proudly erect. Occasionally they would exchange words with one another in a monosyllabic language.

New Discovery "No-Frost" Offers $15 a Day PROFIT!



Here's an absolutely new money-making idea. Brings big profits—easy profits—QUICK PROFITS! You can make $1.50 to $2.00 an hour in spare time—$3 to $15 in a day—helping me handle orders in your territory for No-Frost. No-Frost is a new scientific preparation that is absolutely guaranteed to keep steam, frost, fog, rain, sleet, mist, and snow off auto windshields, street car windows, show windows, mirrors, etc. Think of it! Keeps glass clean, bright and clear in all kinds of weather.

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All you do is demonstrate to housewives, auto owners, taxicab and bus companies, stores, garages, etc., and take orders. We don't sell to dealers. All business from your locality must come through you. You alone get the profit on every order. Easy to demonstrate. Just put a little No-Frost on the glass. It doesn't show. It won't streak, smear, mar or scratch. Yet keeps glass clean and clear as crystal. A necessity for every auto owner, storekeeper, street car motorman, taxicab and bus driver, locomotive engineer, and housewife.

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SEND NO MONEY

Just put your name and address on the coupon. Give me a chance to prove that you can make $6 to $15 a day. You don't need capital, training, or experience. I furnish everything and tell you just what to do and say in this easy, pleasant work. You don't risk a penny. Yet it's an opportunity to pocket hundreds of dollars in clear cash profits. You can make big money—right from the start. Introduce No-Frost in your territory while it's new and before imitations are put on sale in the stores.

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LOST INSIDE THE EARTH

Dian the Beautiful

HOW far we marched I have no conception, nor has Perry. Both of us were asleep much of the time for hours before a halt was called—then we dropped in our tracks. When our guards aroused us from sleep we were much refreshed. They gave us food. Strips of dried meat it was, but it put new life and strength into us, so that now we too marched with high-held heads, and took noble strides.

By this time we had picked up a smattering of the bastard language in which our guards addressed us, as well as making good headway in the rather charming tongue of our co-captives. Directly ahead of me in the chain gang was a young woman. Three feet

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WANTED—a reliable man or woman in every community to make *nationally advertised* "Brown Bobby" greaseless electric doughnuts to fill orders for wholesale and retail trade. Chas. Minch, Fla., cleared $3,000 in 3 months; Iota Blanton, Ia., $400 in 26 days; H. G. Landroth, Ia., $60 a day. Inexperienced but ambitious men and women everywhere are cleaning up by the "Brown Bobby" plan.

No Training Needed

We Furnish Everything

No experience or baker's skill needed. You simply add water to the prepared "mix" we send; marvelous doughnut maker does the rest. You can start making doughnuts at home by the "Brown Bobby" process; later on you can rent floor or window space, or open shop. Small investment required to show you mean business. *We will help you sell your entire output!*

Typical Successes

Mrs. A. J. Miller, N. Y., cleared $24 a day, buys a hotel with "Brown Bobby" profits.

* * *

Mr. F. D. Morrow, Ill., rents grocery window, clears $40 a day.

* * *

Mrs. J. H. Toulouse, N. M., from her home builds $12-a-day profit business in 4 weeks.

* * *

Mr. J. D. Hecker, Ill., sells 400 dozen daily at profit of 12c per dozen.

INVESTIGATE This Proven Plan

For the sake of your future, write for details now! Learn what others are doing, what you can do, how in a few weeks you can be earning up to $1,000 a month. Now is the time to get started. Don't wait.

Mail Coupon NOW!

GEORGE HARDY, Director of Distribution,
Food Display Machine Corporation,
Dept. 3672 500-510 N. Dearborn St., Chicago

Gentlemen: Please send me without cost or obligation the "Brown Bobby" plan by which I can make $50 to $200 a week.

Name.....

Address.....

City..... *State*.....

Before Kenneth McCarty Mailed that Coupon He was an $18.00 Clerk—

Today His Income is $85.00 a Week

After completing the course he wrote us: "Yours is the finest course ever presented for the Tenor Banjo. Before I enrolled with you, I knew nothing whatever about music. I was earning $18.00 weekly clerking in a store. **Little did I realize the opportunity that had come.** I took up the course just for fun. But here I am playing in one of the best Orchestras in western Michigan and **making $85.00 a week.** Your course and your kind co-operation have made me a professional Tenor Banjoist."—Kenneth McCarty, Parkview Hotel, South Haven, Mich.

Play for Fun or $5,000 a Year

Whether a salary of $65 to $100 a week—or spare time playing at $5, $10, $15, or more a night—interests you or not—think of the fun in store for you. In one to three months we can train you at home to play this marvelous, melodious instrument with a fine easy skill that will make you the envy of all other eyes. Think, too, of the pleasure of being able to express yourself musically when alone! You're passing up the **best times** of your life if you pass up an opportunity like this to learn at slight cost and with no inconvenience at all the world's most popular instrument. DON'T DO IT! Decide NOW to learn more about The Play-Way—the quickest, surest short-cut ever devised to social and professional success.

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Every selection of the course, fifty-five in all—comes to you on a phonograph record. You hear the instructor's playing just [illegible] though he were right a[illegible] side. The Play-Way is different, interesting, FOOL PROOF. Get the good news the coupon brings. SEND FOR IT NOW!

Big Tenor Banjo comes with Course

FREE BOOK TELLS HOW

Send at once for "The Play-Way to Popularity and Big Pay." Learn all about our unique method of training you at home, about the big, professional size Tenor Banjo, Phonograph Records and complete Outfit that we send you along with your very first lesson. Undreamed of possibilities for pleasure, popularity and big pay are open to you the minute you "become good." The book below is your first step. Take it now. Clip the coupon while it's here before your eyes.

Get Big Free Book

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NEW YORK ACADEMY OF MUSIC,
Studio 128-029 100 Fifth Avenue,
New York City.

Send me the book that started McCarty. No obligation whatsoever on my part, understand.

Name .....

Address .....

LOST INSIDE THE EARTH

of chain linked us together in a forced companionship which I, at least, soon rejoiced in. For I found her a willing teacher, and from her I learned the language of her tribe, and much of the life and customs of the inner world—at least that part of it with which she was familiar.

She told me that she was called Dian the Beautiful, and that she belonged to the tribe of Amoz, which dwells in the cliffs above the Darel Az, or shallow sea.

"How came you here?" I asked her.

"I was running away from Jubal the Ugly One," she answered, as though that was explanation quite sufficient.

"Who is Jubal the Ugly One?" I asked. "And why did you run away from him?"

"Jubal the Ugly One placed his trophy before my father's house. It was the head of a mighty *tandor*. It remained there and no greater trophy was placed beside it. So I knew that Jubal the Ugly One would come and take me as his mate. None other so powerful wished me, or they would have slain a mightier beast and thus have won

Tobacco Habit BANISHED

Let Us Help You

No craving for tobacco in any form after you begin taking Tobacco Redeemer. Don't try to quit the tobacco habit unaided. It's often a losing fight against heavy odds and may mean a serious shock to the nervous system. **Let us help the tobacco habit to quit YOU.** It will quit you, if you will just take **Tobacco Redeemer** according to directions. It is marvelously quick and thoroughly reliable.

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Tobacco Redeemer contains no habit-forming drugs of any kind. It is in no sense a substitute for tobacco. After finishing the treatment you have absolutely no desire to use tobacco again or to continue the use of the remedy. It makes not a particle of difference how long you have been using tobacco, how much you use or in what form you use it—whether you smoke cigars, cigarettes, pipe, chew plug or fine cut or use snuff, **Tobacco Redeemer** will positively remove all craving for tobacco in any form in a few days. This we absolutely guarantee in every case or money refunded.

Write today for our free booklet showing the deadly effect of tobacco upon the human system and **positive proof** that **Tobacco Redeemer** will quickly free you of the habit.

Newell Pharmacal Company,
Dept. 867 Clayton Station, St. Louis, Mo.

LOST INSIDE THE EARTH

me from Jubal. My father is not a mighty hunter. Once he was, but a *sadok* tossed him, and never again had he the full use of his right arm. My brother, Dacor, the Strong One, had gone to the land of Sari to steal a mate for himself. Thus there was none, father, brother, or lover, to save me from Jubal the Ugly One, and I ran away and hid among the hills that skirt the land of Amoz. And there these Sagoths found me and made me captive."

"What will they do with you?" I asked. "Where are they taking us?"

Again she looked her incredulity.

The World of Mahars

I CAN almost believe that you are of another world," she said, "for otherwise such ignorance were inexplicable. Do you really mean that you do not know that the Sagoths are the creatures of the Mahars? Next you will be telling me that you never before heard of the Mahars!"

About all I gleaned of them was that

Electric Motor FREE

A powerful electric motor equipped with driving pulley, and two-blade fan, mounted on polished wooden base, binding posts, control switch. Runs mechanical toys beautifully from battery. A little gem, you may have it free WITH

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50 pages a month crammed with thrilling fiction and action stories, written for real live, red-blooded boys. It is the hit of the year. Regular subscription price $1 a year. We will send you 12 issues—a year's subscription—and this great electric motor all for $1. Order now. Just drop a dollar bill to us, we pay shipping charges.

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$2.00 DOWN BALANCE EASY TERMS

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Experience the joy this personal writing portable typewriter can give you! Use it 10 days free! See how easy it is to run and the splendidly typed letters it turns out. Ideal for the office desk, home, traveling. Small, compact, light, convenient. Don't send out letters, reports, bills in poor handwriting when you can have this Corona at such a low price or on such easy terms.

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Leatheroid carrying case, oiler, instructions free on this offer. Send no money—just the coupon. Without delay or red tape we will send you the Corona. Try it 10 days. If you decide to keep it, send us only $2—then $3 a month until our special price of $39.90 is paid (cash price $36.40). Now is the time to buy. This offer may never be repeated. Mail coupon now.

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Ship me the Corona, F. O. B. Chicago. On arrival I'll deposit $2 with express agent. If I keep machine, I'll send you $3 a month until the $37.90 balance of $39.90 price is paid; the title to remain with you until then. I am to have 10 days to try the typewriter. If I decide not to keep it, I will repack and return to express agent, who will return my $2. You are to give your standard guarantee

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READ HOW WE CAN BOTH MAKE BIG MONEY!

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Men! Here's a specialty you can sell — It's new. It's something every motorist, radio fan or office worker will buy on sight. It holds a watch, a package of cigarettes and a pack of matches, all in one. The beauty of it is that it is made with a clever handy suction grip permitting your customer to just stick it on and it is there to stay without any screws, boring, nails or any fussing whatsoever. Easily removed by just relieving the suction. **Auto drivers alone present an unlimited field for salesmen**, but what they have been looking for. They can tell the time, snatch a cigarette and get a light in a jiffy. Eliminates fussing around pocket—brings those necessities at the fingertips at all times. A sure winner that you can make an easy **$1,000 within 90 days.**

15% Clear Handy Pak is handsomely made of a durable non-metal, beautifully colored and lacquered finished, thereby making it a beautiful ornament besides being very useful. It retails at $1 each and pays you **150% profit** and more on each and every one you sell. Handy Pak is a handsome, beautifully colored display case, twelve to a case. Just the kind of display that gets automatic sales on dealers counters. Order in large quantities and get the rock bottom price. You can't lose—so positive are we that you can sell them that we guarantee to take back any that you cannot sell and refund your money. Order now while this proposition is new and reap the big harvest of big profits for yourself.

A Watch Free With Every Dozen

In order to help your sales and to make your demonstration complete, we include a watch free with each and every dozen you purchase. This watch contains an American standard movement and is guaranteed to keep excellent time. You can sell the watch for at least $2.00, which means extra profit for you, at least $8.00 on every dozen you sell.

Get Started While Handy Pak is New—RUSH COUPON TODAY

This proposition promises to be one of the most sensational overnight successes in the history of direct selling. If you want to enjoy the thrill of making big money with the least amount of effort, send in the coupon today along with 50c for a sample, or better yet, send $6.00 for a dozen and receive a free watch and start selling at once. I guarantee that you will sell out in less than a half hour and pocket your $3.00 clear profit—then you will come back for more and order in half gross lots, because you will be convinced that Handy Pak is the quickest you have been waiting to sell—Seek no longer—Act now!

New Invention Sales Co.

Dept. 510 303 Fourth Ave. New York

New Invention Sales Co.,
Dept. 510, 303 Fourth Ave.,
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Your proposition looks right to me. With the understanding that I can get my money back, kindly send me the amount of goods I have checked below. Also enclose your instruction plans showing me how I can make $1,000 or more within 90 days.

☐ 1 sample Handy Pak and Sales Plans.....$ .50
☐ 1 Doz. Handy Pak and 1 free watch and sales plans.... 6.00
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If **You Order a Sample Please Enclose Cash. For Other Orders Send 25% Cash With Order and Pay Balance C. O. D.**

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City ..... State .....

LOST INSIDE THE EARTH

they were quite hideous, had wings, and webbed feet; lived in cities built beneath the ground; could swim under water for great distances, and were very, very wise. The Sagoths were their weapon of offense and defense, and the races like herself were their hands and feet—they were the slaves and servants who did all the manual labor. The Mahars were the heads—the brains—of the inner world. I longed to see this wondrous race of supermen.

Perry learned the language with me. When we halted, as we occasionally did, though sometimes the halts seemed ages apart, he would join in the conversation, as would Ghak the Hairy One, he who was chained just ahead of Dian the Beautiful. Ahead of Ghak was Hooja the Sly One. He too entered the conversation occasionally. Most of his remarks were directed toward Dian the Beautiful. It didn't take half an eye to see that he had developed a bad case; but the girl appeared totally oblivious to his thinly veiled advances.

At the next halt Hooja the Sly One managed to find enough slack chain to permit him to worm himself back quite close to Dian. We were all standing, and as he edged near the girl she turned her back upon him in such a truly earthly feminine manner that I could scarce repress a smile; but it was a short-lived smile for on the instant the Sly One's hand fell upon the girl's bare arm, jerking her roughly toward him.

I was not then familiar with the customs or social ethics which prevailed within Pellucidar; but even so I did not need the appealing look which the girl shot at me from her magnificent eyes to influence my subsequent act. What the Sly One's intention was I paused not to inquire; but instead, before he could lay hold of her with his other hand, I placed a right to the point of his jaw that felled him in his tracks.

In the next installment of this fascinating serial, David and Perry are imprisoned in the underworld city of Mahars, where they are confronted with amazing dangers. Read the next chapters of this great story in March Modern Mechanics, on all newsstands February 1st.

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You can easily be your own boss and make real money the year around with this wonderful machine. We'll help you with a FREE PLAN! Follow it and you'll get steady saw filing business from carpenters, contractors, schools, woodworking plants, factories and homes. NO CANVASSING. The Foley files all kinds of saws automatically. Easy and simple to operate—no experience necessary. No eye-strain. Makes saws cut better than ever. Write for the FREE PLAN that will get you started in this well paying business. No obligation.

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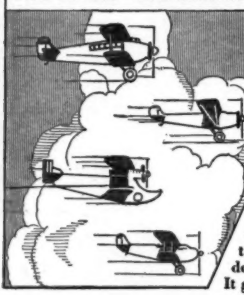

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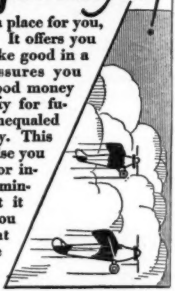

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Mrs. Bower, a W. Va., housewife writes: "I am always sure of $10 a day profit with Health-O Products."

$31.65 First Day

"Just received sample case. Started among acquaintances and first day made $31.65."—B. L. Simmons, So. Car.

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Ruth Hoffman never sold a thing before in her life. She proved that experience was not necessary—she writes: "Made $101.25 first week."

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T. J. Osborne two days after receiving sample case enthusiastically writes: "I have been out only two evenings and have taken orders for $24.85."

Easy for you to make big money. I look out for welfare of my partners.

I don't want you to take any chances. I GUARANTEE your income. This is the most amazing guarantee ever made for a steady, year 'round income. I can make this **guarantee** because I know you can do as well as my other partners whose letters are shown on this page.

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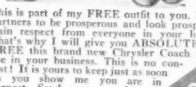

This is part of my FREE outfit to you. I want my partners to be prosperous and look prosperous to gain respect from everyone in your locality. That's why I will give you ABSOLUTELY FREE this brand new Chrysler Coach to use in your business. This is no contest! It is yours to keep just as soon as you show me you are in earnest. Send coupon today.

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30 Selections

$11.25 worth of high grade 75c records included in this offer. 30 selections—15 double face records. Made by the *new electric process;* more life like, more volume, less surface noise. Play longer. Very latest popular songs, dance music, band and instrumental pieces. Read our wonderful offer.

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$1.00 *down* brings it on 30 Days Trial

Yes, only $1.00 with coupon below brings you this portable phonograph with a special assortment of 15 latest double-face 75c *new electric process* records—30 selections in all. Think of it—$11.25 worth of brand new records included on this sensational offer! Use this wonderful portable as your own. See what a wonderful convenience it is to have a phonograph that you can carry wherever and whenever you want it.

We guarantee: that you get everything in this phonograph so far as concerns music reproduction that a $250 phonograph can give you, also exact reproducer, exact style of tone arm and the same grade of records. That's why you get, on this wonderful offer, **absolutely the best in music that any phonograph ever gave.**

$2.50 a Month

If within 30 days you decide not to keep the outfit, send it back and we'll refund your $1.00 plus all transportation charges. If you keep it, pay only $2.50 a month until you have paid that sensational price on this special sale—only $24.95. Think of it, a first class high grade phonograph and 15 latest double face Records (30 selections) a complete outfit, ready to play, only **$24.95!** Seize this opportunity while it lasts! Send the coupon NOW!

Free Catalog of home furnishings sent on request with or without order. See coupon.

Straus & Schram, Dept. 4732 Chicago

***New* Portable Phonograph**

Light and easy to carry. Ideal for every purpose. Plays all records with wonderful tone and volume. Beautifully covered in red Baby Alligator genuine DuPont Fabricoid (absolutely waterproof.) This portable is equipped with many new, exclusive features, including a long air column horn of the newest type, the finest reproducer on the market, a strong pulling, even running motor, double nickeled hardware throughout, self contained album to conveniently carry 15 records.

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Folds Like a Suitcase with snap locks and carrying handle. So light and convenient — easily carried wherever you want it.

Plays any standard 10-inch disc record. Plays two ten-in. records with one winding. Weight 17 lbs. Waterproof imitation leather case, with hinged lid. Size 16 x 12 x 8½ in. Records inside of lid are secured so they will not rattle or break. Holds 15 records. Has quiet spring motor, tone arm and reproducer with indestructible diaphragm and wide throat for full sound volume. Outfit includes 15 double face 75c New Electric Process Records—30 selections. Shipping weight packed about 25 lbs.

Order by No. W3136WA—only $1.00 with coupon, $2.50 monthly. Total price, $24.95

Straus & Schram, Dept. 4732 Chicago, Ill.

Enclosed find $1. Ship special advertised Puritone Portable Phonograph with 15 Double Face 75c *New Electric Process* records—30 selections. I am to have 30 days free trial. If I keep the outfit, I will pay you $2.50 monthly. If not satisfied, I am to return the phonograph and records within 30 days and you are to refund my dollar and express charges I paid.

Puritone Portable Phonograph and 15 Double Face Records, W3136WA, $24.95.

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Post Office..... *State*.....

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If you want only our free catalog of home furnishings, mark X here ☐